ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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What in the World!

Biggest news of last week was the filing of an electric light and power code with NRA and the tendering of resignations to Edison Electric Institute because of it by the Hartford group and the Baltimore companies.

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To sober, studied judgment there are practical, legal and regulatory bases for questioning the propriety of any federal code for state-regulated utility enterprises.

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Perspective is the rarest gift of the day. "What," storms many a commercial man, "spend money to develop sales? No sir; we want profits to show up this year, not years from now." Yet the utility business must extend over a long period of time and nothing but sales can possibly offset taxes.

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Again, there are those who see no menace in the overcapacity myth. They look at the charts and they examine the figures. They shake their heads. "Don't know what the catch is, but there is something funny about it. We can't be back on that basis"—and there you are. Time and load peaks wait for no utility.

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Encouragement and sanction given to the use of bare neutral wiring by the new Underwriters' code definitely indicate that the approval of new materials and designs for service cables may be looked forward to, when and if the proper development has been made and the adequacy and safety of the newer materials demonstrated, concludes O. K. Coleman in discussing service cable development under the new code. Of course, that is the way that progress is made, one step at a time. The world is not often remade in a few hours.

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WE DO OUR PART

AUGUST 19, 1933

Contents, Copyrighted, 1933, by McGraw-Hill Publishing Company, Inc.
VOLUME 102 . . . NUMBER 8

Motor Duty Cycles Computed by New Method 236
BY T. R. RHEA, *General Electric Company*

Manufacturing Code Approved 242

Service Cable Development Under New Code 245
BY O. K. COLEMAN, *American Gas & Electric Company*

Distribution Costs of Electric Service 248
BY CONSTANTINE BARY, *Philadelphia Electric Company*

Editorials 234
Industrial Advance Shown by Energy Use 240
Timing Oil Breakers 241
Clamp Connections Give Flexibility to Transformer Structures 244
Chinese Plants Generate 2.5 Billion Kw.-Hr. Annually 247
Peripheral Turbine Speed 346 Miles per Hour 252
Two-Speed Spinning Frame Drive Increases Output 253
Readers' Forum 253
Book Reviews 254
Men of the Industry 255
New Equipment Available 256

Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

Published weekly. $5 per year. 25 cents per copy. Central and South American countries, $7. Foreign, $9 U. S. currency, or 45 shillings per year. Canada subscription price (including Canadian duty), $7.50. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Cable Address: MCGRAWHILL, N. Y. Member A.B.P. Member A.B.C.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President; Harold W. McGraw, Vice-President; B. R. Putnam, Secretary.

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ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

August 19, 1933

Electric Code Emphasizes New Problems

THAT CLOUD which drifted over the situation when the code presented by the Edison Electric Institute to the NRA on behalf of the electric light and power industry brought resignations from the institute of two important independent organizations has been little dissipated by the events of the past week. Involved are the question of states' rights, of institute representation and of codes of fair competition for non-competitive industry. Judging by the first reactions to the situation, state commissions may be reluctant to permit the offsetting of higher costs induced by NRA co-operation for the relief of the utilities. The code was revised somewhat before acceptance for formal consideration by the NRA. The changes had to do with relatively minor elements in the section (III) concerning wages and working hours.

Public announcement has thus far been made specifically on behalf of a number of properties that they will, through the Edison Institute, co-operate with the NRA both upon the basis of the President's re-employment agreement and of the industry code which may be approved. Action by New Hampshire and Vermont companies may be delayed pending the outcome of the present pending questions in Washington regarding the potential conflict of state and federal authority. The regulatory commissions of both states are in touch with NRA directly.

President Ferguson of Hartford Electric Light and affiliated companies in referring to the withdrawal of his organizations (ELECTRICAL WORLD, August 12, page 193) has stated further that resignation from the institute was offered "'at the pleasure of the board' to put the institute in a position to take unanimous action, if it so desired. We feel it necessary to delay the signing of any broad and comprehensive agreement to submit to federal regulation in all matters until the question of conflicting state and federal jurisdiction has been straightened out."

Why Baltimore withdrew

In Baltimore the reasons behind the withdrawal of Consolidated Gas, Electric Light & Power from the E.E.I. fold have been more sharply defined. President Wagner has stated:

Our resignation from the E.E.I was largely forced by the decision of the board of trustees of the E.E.I. to formulate a code and present it to the NRA at Washington. My position was that the utilities, being the only industries which had heretofore been regulated and which were regulated as to competition, rates and service by state commissions, could not logically or by any stretch of the imagination be regulated by a federally authorized "Code of Fair Competition," particularly considering the fact that none of them were in competition with each other.

As we intended to present our own position and intentions to General Johnson . . . assuring him of our conformity with the President's plan for re-employment in so far as wages and hours were concerned, and could not at the same time agree to take part in submission of a code of fair competition . . . it was necessary to be able to state that the E.E.I. was not representing us . . .

As to the E.E.I., I saw that it was more than ever evident that it was being dominated by holding company executives and at their recent meetings these executives all agreed with me in principle, but got together . . . under a leadership which assured them that by joining in a code they could negotiate better terms as to wages and hours, however illogical the code might be otherwise. The constitution of the institute declares that it is not a "trade organization," and yet in submitting a code to the NRA it must declare, and amend its constitution if necessary therefor, that it is a trade organization acting for its company members. It thus changes from an association for the benefit of its membership in an advisory capacity to one which undertakes to represent the electric utility industry in matters of national importance. These changes in status I could not go along with.

No rise in Maryland rates

In a letter to H. S. Bridges of the New Hampshire Public Service Commission, made public late last week, Harold E. West of the Maryland Public Service Commission stated:

This commission brought no pressure whatever upon the Consolidated Gas, Electric Light & Power Company of Baltimore or any other utility in the state to resign from the Edison Electric Institute or any other organization in order to avoid signing a code or codes of fair competition, nor have we requested utilities to refrain from signing codes on the ground that the signing of such codes would be an invasion of states' rights.

I told Mr. Wagner . . . that our commission was heartily in favor of the drive to increase employment and wages, but that he could not expect to recover the $250,000 additional cost to his company out of rates. Moreover, he could not sign away the authority of the state of Maryland over his company. I also told Mr. Wagner that we did not see the justice of increasing the costs of electricity to the 200,000 customers of his company in Baltimore in order to secure benefits for its comparatively few employees. Therefore the company will have to absorb whatever costs might be incurred by compliance with the President's program.

President Wagner's comment upon this was:

Nevertheless we have adopted the President's plan in spite of what it may cost us.

New Hampshire early acted to obtain a federal ruling on the situation in so far as state regulation is affected and received contradictory information.

In Connecticut Chairman R. T. Higgins of the Public Utilities Commission has stated that in the several rate cases pending before the commission the NRA codes adopted by the utility industry will have to be considered in conjunction with determining the rate issue. This has been interpreted to mean that relief for Connecticut utilities may be accorded where compliance with the federal re-employment campaign works demonstrable hardships upon investors and their right to return on capital invested. Chairman Higgins has voiced disapproval of the relinquishment of state authority to the federal government, stating that in his opinion the purposes of the federal government can be accomplished so far as the utilities are concerned if the companies will merely live up to the spirit of the codes.

In Texas Chairman Smith of the Railroad Commission states that whether or not present income will absorb increased expenses and yield a fair return on the fair value of property can be determined only after consideration of all pertinent facts. It is held, however, that the code contemplates that every business co-operating as far as possible will absorb this increased expense without passing it on to an overburdened public.

In Virginia temporary delay in the investigation of electric rates has resulted from the uncertainty regarding effect of higher payrolls under the National Recovery Act on operations of the utility companies, Allen J. Saville, head of the organization gathering data to present to the Virginia Corporation Commission, has stated.

Utility code amended

Changes made in the preliminary draft of the electric light and power code as presented in ELECTRICAL WORLD last week (page 193) consisted in alterations to Section III. The following substitutions and additions have been incorporated in the code now in General Johnson's hands for hearing.

III (a) No employee shall work for more than an average of 40 hours per week during any six weeks period except those specified in paragraph (b):

(b) Load dispatchers, emergency maintenance and repair employees, station and substation operators, with their respective attendants, crews and helpers, if highly trained and not readily replaceable, whose duties must be continuously performed in order to render to the public safe and continuous service may be employed not in excess of 48 hours per week so long as other competent employees are not available for such work and in emergencies such employees may work more than 48 hours per week, but in no case shall the hours exceed an average of 48 hours for six consecutive weeks. All employers subject to this code shall proceed with the training of additional employees as rapidly as is consistent with the rendition of safe and continuous service so that by March 1, 1934, as many employees as possible may be reclassified under the 40 hours per week limitation, and reports shall be made on said date of the extent of such reclassification to the National Recovery Administration.

(c) The maximum hours fixed in the foregoing paragraphs shall not apply where not more than two persons are employed in communities of less than 2,500 population, which communities are not part of a larger trade area; nor to employees engaged in emergency work; nor to outside salesmen; nor to employees in a managerial, executive, administrative or supervisory capacity who now receive more than $35 a week. Population for the purposes of this agreement shall be determined by reference to the 1930 Federal Census.

Section III B becomes III d and subsections (a) (b) (c) and (d) become (1) (2) (3) and (4), to which (5) has been added.

(d) 5. This paragraph shall apply to all employees except those covered by provisions of the following paragraph (e):

(e) Employees of the classes who on July 1, 1933, were paid an hourly rate shall be paid not less than 40 cents per hour unless the hourly rate for the same class of work on July 15, 1929, was less than 40 cents per hour, in which latter case the rate of pay shall not be less than the July 15, 1929, hourly rate of pay, and in any event shall not be less than 30 cents per hour; that learners may be paid not less than 80 per cent of the minimum wage rate provided in the above schedule, but the total number of learners shall not exceed 5 per cent of the total number of employees employed by any employer subject to this code.

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Better Indirect Lighting Follows Co-ordinated Plan

Doubling the average light intensity at counter level from 5 to 10 foot-candles without emphasizing the location of the light sources is the accomplishment of a wholly indirect lighting installation recently made on the ground floor of the Marshall Field store in Chicago. One of the largest installations of its kind in the world, this involves lighting an area of 86,198 sq.ft. To the illuminating engineer the most conspicuous feature of the installation is the remarkable inconspicuousness of the light sources. Nowhere on the ceiling can be seen the splashes of light that indicate lamp locations in many indirect lighting applications. Only at unobtrusively infrequent intervals along the walls can be observed a few places where supplemental strip lighting reveals its presence.

Most of the general lighting units, 750-watt lamps, are concealed in square boxes about 18 in. across and about 10 in. high with mirror sides, resting on the tops of the islands of shelf structures inside the counter inclosures. The height of the units is thus about 6 ft. from the floor and 12 ft. below the ceiling. At places where shelf structures are not available the units are made up into what look like slightly over-size portable lamps which stand on the show cases. The units are top inclosed with heat-resisting glass, are equipped with silver mirror reflectors and are large enough for 1,000-watt lamps if it is wished to increase the light intensity later. Distances between units vary from 13 to 22 ft., depending on light concentrations desired at various areas. The general illumination from these large units is supplemented by strip lighting concealed in coves along the walls about 8 ft. below the ceiling. Here are used 40- and 50-watt lamps on 12-in. spacings. Engineers of the Pittsburgh Reflector Company and the Reflector & Illuminating Company co-operated in installation.

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Saratoga, N. Y., in Darkness

Visited by one of the most severe wind and rain storms in years, Saratoga Springs, N. Y., was reported to have been temporarily without electric service this week as wires and poles fell beneath the fury of the storm and the weight of falling trees and branches.

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Michigan Regulation Costs More

Following the failure of the Michigan Legislature to do away with the present Public Utilities Commission and create instead of the five-men body a board of three members, the commission's payroll has increased $24,000 a year, due in part to an increased staff which the commissioners now declare to be necessary. The voluntary cut which members of the commission took last year became past history some time ago and they are accepting the full legal pay checks.

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Tennessee River Closed to Private Development

Under a policy laid down by the Tennessee Valley Authority, there will be no private development of power on the Tennessee River or its tributaries. Returning from a visit to the valley area last week, David E. Lilienthal, a member of the authority, stated the board's view to be that it alone should be charged with all development on the river and its tributaries. The question of whether the authority was to have exclusive right to development on the river or whether private interests could share in it was brought to the fore by the pending expiration of a preliminary permit from the Power Commission held by Southern Industries & Utilities, Inc., for a development at Aurora, Tenn.

W. G. Waldo, president of the corporation, had asked that either the preliminary permit be extended or a permanent one granted. The position to be taken by the Power Commission was unknown, but officials speculated that, in view of the policy pronounced by Mr. Lilienthal, the Power Commission would hesitate to renew the permit or grant a permanent one.

Two sites owned by the Swann Corporation of Birmingham on the Nolichucky and Hiwasee Rivers in Tennessee are also affected by the policy laid down by the authority. The Swann Corporation purchased the sites several years ago at a reported price of $1,400,000. The dams and power plants were not built, it was said, because the company obtained a more favorable contract from a private power company, but the sites have been kept as a potential source of power. Recently the Swann Corporation offered to exchange the sites with the Tennessee Valley Authority for power supplied at the switchboard at Muscle Shoals.

T.V.A. divides duties

Tennessee Valley Authority board of directors has allocated specific duties to its three members. Chairman Arthur E. Morgan will supervise all matters concerned with Norris Dam, reservoir and town of Cove Creek, in addition to numerous other features of development. Dr. Harcourt A. Morgan has been placed in charge of all matters relating to agriculture. David E. Lilienthal will look after the distribution of power, land appraisals, operation of the generating plants at Muscle Shoals, construction and operation of transmission lines and accounting work.

▽

Revenue Commissioner Rules on Federal Tax Shift

Preparatory to the shift of the federal 3 per cent tax on energy generated from consumer to producer G. T. Helvering, Commissioner of Internal Revenue, has issued a series of rulings. Under the provisions of the present law the tax must be paid by the domestic or commercial consumer of energy furnished up to and including August 31, irrespective of the time when payment for the energy is made, and despite the action of Congress in amending this section of the tax bill to place payment upon the producer rather than the consumer.

On and after September 1, Mr. Helvering ruled, all vendors of electrical energy will be liable for the tax on sales for domestic or commercial consumption, but not for resale. Publicly owned electrical power plants will not be liable for the tax, though their sales are for domestic or commercial uses.

To Speed the Campaign

With a zeal which recognizes no defeat and accepts setbacks as but events of the moment, NRA labors to instill in America that spirit of complete co-operation upon which the campaign depends. Further intensification of effort is promised by General Johnson in the next two or three weeks. The potential buyer is to become an actual purchaser of goods, in many cases, already manufactured. NIRA has won its first court test, brought by the oil industry.

Indexes need bolstering to regain lost ground. Energy production, so long the leader in upward trends, is wavering. Carloadings dropped 4 per cent from the previous week as shown by the most recent figures. Similarly, automobile production declined 5.5 per cent. Lumber production index off 8 per cent from the average rate of the past three weeks. Steel output declines. Money in circulation $110,000,000 less than at this time last year. Security and commodity markets show little strength in inactive sessions. General business indexes continue the decline begun several weeks ago. Price indexes hold relatively steady under mixed gains and losses. The consumer drive is designed to offset these tendencies.

In the electrical field: Utilities face problems of increased costs of operation under higher and more numerous taxes, and with larger payrolls, but without assurances of offsetting rate gains, for commissions indicate adamantine unsympathy; electrical manufacturers tackle the difficult and complicated task of developing procedures which will enable them effectively to put the N.E.M.A.-NRA code to work. In the meantime they find their business to be improving.

The magazine publishers have submitted a code for their industry and signed the President's re-employment agreement. "Electrical World" now bears the Blue Eagle.

Texas Municipal Plant Case Carried to Supreme Court

Unwilling to abide by the decision of the United States Circuit Court of Appeals at New Orleans, reversing the decision of the lower court which had issued an injunction restraining Fairbanks, Morse & Company from entering into contracts with 65 communities in Texas for the construction of electric light and power plants (ELECTRICAL WORLD, March 11, page 311), the Texas Electric Service Company has filed a petition with the Supreme Court of the United States appealing the case.

The point at issue is whether an electric light and power company which had entered into so-called "requirements" contracts with 90 per cent of its customers in many municipalities in Texas, by which it agreed to furnish and the customers agreed to take and pay for the amount of current required for use, and not for resale, at standard rates subject to governmental regulation, was entitled to an omnibus injunction restraining a seller of power plant equipment from attempting to induce the municipalities to enter into contracts for the construction by the seller of municipal plants to be paid out of the revenues from their operation, where the necessary effect would be to cause the customers of the power company to breach their requirements contracts with it, since the power plant equipment seller required assurance, before it would agree to construct a plant for a municipality, that at least 70 per cent of consumers would make exclusive contracts with the municipality for electric current.

On the other hand, the question is also involved as to whether the requirements contracts of the power company constitute a system of contracts tending to establish a monopoly, and as such, whether they are against the public policy of Texas and not entitled to protection by injunction against acts inducing their breach; whether the contracts are violative of the Texas anti-trust laws, and whether the evidence of threatened interference with the power company's contracts with its customers was sufficient to support an omnibus injunction.

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Philadelphia Electrical Show

For the sixth year Philadelphia will have an annual electric and radio show. Sponsored by the Electrical Association of Philadelphia, the show will be held October 2 to 7 in the Municipal Convention Hall.

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Cuban Electric Undamaged

Though Cuba this week seethed with mob violence, revolution and strikes, it is reported that the Cuban Electric Company, subsidiary of American & Foreign Power Company, suffered little damage, confined mostly to the destruction of windows and, in Oriente Province, some loss in office equipment. Employees of this organization did not join in the general strike.

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Combustion Engineering Company

Properties of the International Combustion Engineering Corporation and affiliated companies, recently sold by order of the federal court, will be operated under a single centralized management by the newly organized successor company, Combustion Engineering Company, Inc. The complete line of fuel-burning, steam-generating and related equipment is to be maintained, as will many of the personnel.

Coming Meetings

Illuminating Engineering Society—Delavan, Wis., August 28-31. D. W. Atwater, 29 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., September 6-8. A. B. Miller, Harrisburg, Pa.

Rocky Mountain Electric Association—Santa Fe, N. M., September 11-13. George E. Lewis, Gas and Electric Bldg., Denver, Colo.

International Association of Electrical Inspectors—Chicago, Ill., September 11-14. V. H. Tousley, 612 No. Michigan Ave., Chicago.

National Electrical Exposition — New York, N. Y., September 20-30. Ralph Neumuller, 480 Lexington Ave., New York.

National Association of Railroad and Utilities Commissioners — Cincinnati, Ohio, October 10-13. James B. Walker, 270 Madison Ave., New York.

Association of Iron and Steel Electrical Engineers—Pittsburgh, Pa., October 17-19. John F. Kelly, Empire Building, Pittsburgh.

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Oklahoma Governor Cuts Commission Funds

Governor Murray of Oklahoma last week formally banned expenditures from the $50,000 appropriation of the corporation commission for public utility investigations during the current fiscal year. Commission employees hired from the fund planned to go to court at once to test his right to dictate the expenditures.

Earlier, the chief executive had demanded that F. C. Carter, state auditor, honor no claims against the fund. Subsequently using the power given him by the Legislature to limit expenditures from quarter to quarter, he ordered the fund stricken.

The employees have retained E. S. Ratliff, former commission attorney, for the court test which will involve validity of the legislative enactment in the general appropriation bills under which the Governor has been paring estimates. Suit for mandamus to force Carter to issue the warrants is planned and may be filed in district court shortly, according to present plans.

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Spokane Taxes Utilities; Court Fight Impends

Occupational license taxes on public utilities in the city of Spokane, expected to produce $140,000 a year, have been imposed through the ordinance passed last week by the City Council with a unanimous vote. The following schedule was adopted: The Washington Water Power Company, 3 per cent; Home Telephone Company, 3 per cent; telegraph companies, 2 per cent; Spokane Gas & Fuel Company, 1 per cent, and Central Heating Company, 3 per cent. The tax is to become effective October 1 and the tax year will date from March 1. Under the ordinance the utilities must obtain licenses from the city auditor, in addition to existing franchises, in order to continue to function there.

The taxes were vigorously opposed by heads of the various utilities. J. E. E. Royer, vice-president and general manager of the Washington Water Power Company, declared that in view of the demands made on large employers by the NRA and the present heavy tax burden the company could not well stand the proposed tax and announced that the matter would be carried to the Supreme Court if necessary to avoid the tax.

▼

Illinois License Withheld by Power Commission

Acting, according to Chairman Frank R. McNinch, "without prejudice" to the application, the Federal Power Commission has rescinded its authority to Illinois licensing power development on the state's waterway. The action was taken to allow the state to answer objections lodged by other Great Lakes states alleging excessive authorized installation.

Minnesota, Wisconsin, Michigan and Ohio protested against the terms of the Illinois license on the ground that the proposed generating installation was in excess of that justified under the limited diversion permitted by the Supreme Court, Mr. McNinch explained.

The protesting states declared that the water-power license, entailing large expenditures by Illinois, might be held to create equities in favor of a greater diversion from Lake Michigan than the Supreme Court decree allowed.

▼

A.S.A. Forms Instruments Committee

American Standards Association has announced the formation of a sectional committee on electrical measuring instruments with E. J. Rutan, superintendent of the testing department, New York Edison Company, as chairman. The work of the committee will be handled by two subcommittees, one on definitions and the other on classifications, rating, methods of testing and construction.

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Current Transformer Standards

Standards for constant current transformers of the moving coil type have been approved by the American Standards Association as American Standard (C57.1-1933). The standards, which cover service conditions, apparatus classifications, duty rating, heating, efficiency, losses, dielectric tests and lead markings, were submitted for approval by the American Institute of Electrical Engineers (A.I.E.E. No. 12).

Insull Officials Sued by Bankruptcy Trustee

Suits to recover $37,000,000 from officers and directors of Corporation Securities Company, bankrupt Insull investment house, have been authorized by Garfield Charles, referee in bankruptcy.

Civil action against all who served on the board or as officers since 1930 until its fall last year were foreseen some time ago when the trustee filed a claim against the estate of the late Edward F. Swift, packer. The claim was $37,308,646.

Sam Howard, trustee in bankruptcy, has been given authority by the federal referee to sue every officer and director for that amount, predicated on the contention that each was responsible for the alleged maladministration and fraudulent stock transactions that led to the collapse of Corporation Securities and affiliated companies. Criminal action also has been taken against a number of those associated with the company in the form of indictments charging use of the mails to defraud.

▼

Nebraska Supreme Court to Hear Municipal Case

Interstate Power Company has challenged in the Nebraska Supreme Court the right of a city to build a lighting plant out of future earnings. Several years ago the court held that where a municipality (Sargent) had been granted authority to erect a plant and had constructed one, it might finance purchases of new machinery and improvements by that method because there was an implied power in the original grant that it might do all things necessary to operate and maintain it. The Interstate Power Company contends that while this doctrine applies where it is impractical to wait for an election to keep the plant operating efficiently, the implied power arises out of the necessities of the case only.

The city of Ainsworth has contracted with the Fairbanks-Morse Construction Company to build a plant and to retain title until the ten-year warrants issued are retired out of future earnings. The Interstate company operates a plant in that city, and there is no dispute that its service is efficient and that its rates are reasonable. It contends to the court that where such a situation exists, lacking entirely in necessity, there are no implied powers, and that the city's entire measure of power lies only in the statute which says that plants may be built out of bonds authorized by a vote of the people and paid by taxation.

The company also attacks the action of the Council in restricting bidders to

those persons willing to use their own money to build a plant and wait for repayment over a period of years and out of future earnings. The immediate result was that the bid of Fairbanks-Morse was $15,000 higher than the plant would cost if competition had been free and open, it is claimed. The contract is also attacked because it provides that the city's engineer is to get $5,200 only if the plant is built, claiming that this is void as against public policy.

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Trade Board Adjourns; Central G. & E. Examined

Income accounts and operating methods of the Central Gas & Electric Company, now in receivership, were examined at hearings held August 8, 9 and 10 before the Federal Trade Commission. M. C. Steele, commission economist, testified that the company was originally organized as the Wisconsin Public Utility Company in Delaware in July, 1925. The name was changed the following March. Central Public Service Corporation acquired control in 1927, retaining the property since that date.

The company owned the stock of one operating company in 1925, but by December, 1931, it controlled directly 21 public utility operating companies and four holding companies. Operating subsidiaries supply electricity, gas, water and heating service to 194,000 consumers in 391 communities located principally in Illinois, Indiana, Michigan, Wisconsin, Maine, Pennsylvania, New Jersey, Maryland, Florida and the provinces of New Brunswick and Quebec, Canada. The company showed a rate of return on average common stock equity which ranged from 11.39 per cent in 1926, 8.90 per cent in 1927, 14.32 per cent in 1928, 12.11 per cent in 1929 and 3.07 per cent in 1930, Mr. Steele stated.

After concluding this study the commission adjourned the utilities investigation until mid-September.

▼

Test of Investigation Cost Assessments in Washington?

Out of dispute over a $2,000 printing bill may come an important ruling on the right to assess a utility for the cost of proceedings against it by regulatory authority. Washington Railway & Electric Company and the Capital Traction Company have refused to pay the cost of printing the court record in litigation over the fares of the two street railways.

The District of Columbia Public Utilities Commission introduced at the past session of Congress a measure specifically to require utility concerns to pay court costs in contests over commission regulations, but final action was not reached.

The companies have refused to obey a notice from the commission that they pay the costs of the printing of the record in the case, and William A. Roberts, commission counsel, has asked the District Supreme Court to set a date for an early trial of suits brought by the commission last year.

▼

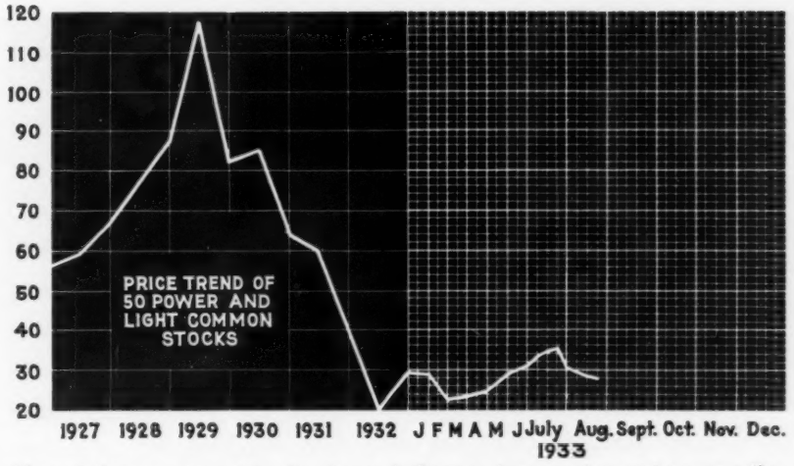
Georgia Ex-Commissioner Charges Political Plot

In a statement addressed to the public late last week James A. Perry, suspended chairman of the Georgia Public Service Commission, attacked the action of Governor Talmadge in ousting the old commission as being "wholly political." "He has publicly announced that he had an understanding with his political appointees in advance of their taking the oath of office that they would cut rates, and if they do not, he will fire them and appoint a board that will do so. Even Governor Talmadge ought to know that such a statement by him sets aside any rate order his political board might promulgate. . .

"The public will soon find that Governor Talmadge is not interested in reducing rates. . . Indeed, a large section of Georgia citizens is now without reduced rates for electric current because of his meddling interference in our work. It is common knowledge that of the entire personnel of 'his commission' not a one has the slightest knowledge of the duties devolving upon a public service commission. It is, therefore, obvious to any one that it will be a long, long time before this handpicked commission can make any pretense of being qualified for the highly technical duties necessary to an intelligent, conscientious discharge of duty."

Efforts are being made at the present time to bring the entire ouster proceedings conducted by the Governor against the old commission before the Superior Court for review (ELECTRICAL WORLD, August 12, page 196).

Stock Market Drifts Lower



Uncertainty appears the dominant influence in security and commodity markets. "Electrical World" stock average dropped to 27.7 this week from 28.5 last. Off for the fourth successive week.

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Associated Plan Sustained by Court

In a recent decision New York Supreme Court Justice Schmuck has denied an injunction against the carrying out of the plan of rearrangement of debt capitalization of the Associated Gas & Electric Company sought by the holder of debentures on behalf of herself and others. The injunction was sought on the grounds of violation of indentures and of the state law which prohibits a corporation from preferring creditors when the corporation is insolvent or in imminent danger of insolvency. Judge Schmuck stated the solvency of the company to be "beyond speculation" in that its assets are at least equal to, if not greater than, its liabilities. Associated won another victory last week in Pennsylvania (August 12, page 197).

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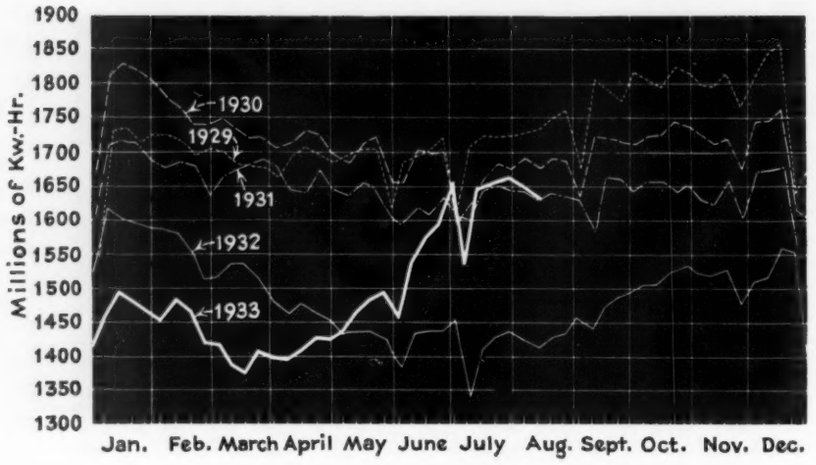
To Harness the Danube

Governments of Rumania and Yugoslavia are planning joint action in the erection of an immense Danube hydroelectric plant and canals at Orsova, on the international boundary. About 750,000 hp. can be developed there. Electrification of railroads and intensification of industry in both countries is the goal, with improved shipping facilities on the Danube.

Week's Energy Output Dips



After running for several weeks on a level slightly above that of 1931, the output of central stations fell off moderately in the week ended August 12, bringing it just under the corresponding output in 1931. As announced by the Edison Electric Institute it amounted to 1,627,339,000 kw.-hr., compared with 1,629,001,000 kw.-hr. two years ago.

There remains a gain of 15.0 per cent over 1932, against a maximum thus far recorded, in the week of July 15, of 16.4 per cent. The Central industrial area continues to be the region of greatest gain over last year. Its increase of 21.0 per cent returns it to the level of 1931. New England, up 19.4 per cent from 1932, is 7 per cent above 1931. The rise on the Coast fails to restore last year's loss.

Weekly Output, Millions of Kw.-Hr.

Week ended	1933	1932	1931	1930
Aug. 12.....	1,627	1,415	1,629	1,677
Aug. 5.....	1,650	1,427	1,643	1,692
July 29.....	1,662	1,440	1,644	1,678
July 22.....	1,654	1,434	1,651	1,686
July 15.....	1,648	1,416	1,645	1,667

Per Cent Change from Previous Year

Region	Week Ended Aug. 12	Aug. 5	July 29
New England.....	+19.4	+21.3	+24.0
Middle Atlantic.....	+10.8	+12.8	+13.6
Central industrial.....	+21.0	+22.7	+21.1
Southern States.....	+17.4	+17.0	+14.0
Pacific Coast.....	+ 6.8	+ 5.9	+ 8.0
United States.....	+15.0	+15.6	+15.4

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New York Drought May Set 50-Year Record

Agitation by summer residents of Indian Lake, N. Y., over the low water levels in that body has led to a gubernatorial investigation and agreement by state and power authorities that an unprecedented drought is in progress in the Adirondacks and Hudson Valley.

E. H. Sargent, head of the Hudson River Regulating District, hearing that complaint had been made over low water levels, said: "The low water level in the Sacandaga Reservoir and in the Hudson is due to the most intensive and protracted drought we have ever had and to a fortunate demand for more water on the part of paper plants along the river to enable them to keep up with increased orders and put more people to work."

An official statement by the International Paper & Power Company asserts in part:

We share with other property owners in the Adirondacks their concern over the low-water levels on the Hudson River watershed this year. This condition is due not to any excessive drafts that have been made on these lakes for power or manufacturing purposes, but rather to the almost unprecedented drought that has been experienced in this region this summer.

If present low run-off conditions continue it is likely that this year will establish a low run-off record for this area for a 50-year period. The run-off on the Hudson and its tributaries is six inches below normal since the first of May.

From a public as well as a private point of view continuous operation of the mills and power plants is necessary because of the many thousands of people employed in these plants or dependent on their output. While not unmindful of the inconvenience that may be caused summer residents, the importance of continued employment particularly at this time has ever been before the State and company officials concerned.

We know of nothing but rain that will help the situation, but are continuing to co-operate in every effort to minimize the effects of the drought on all concerned.

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French and Italian Output

Indications of general improvement in the industrial position of France and Italy are afforded by the continued increase in output of electricity in those countries. In France the production of the 50 principal electric power stations, representing about 64 per cent of the total French output, amounted during the five months ended with May last to 4,065,854,000 kw.-hr., as compared with only 3,782,245,000 in the corresponding period of 1932, an increase of 7.26 per cent. In Italy the output during the similar five months increased from 3,928,752,000 kw.-hr. in 1932 to 4,278,744,000 this year, an advance of 8.91 per cent.

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Ontario Hydro Reduces Rates; Makes Refunds

Decreases in rates to 73 municipalities and refunds of accumulated surplus to 50 municipalities have been instituted by the Ontario Hydro-Electric Power Commission. The refunds will amount to $250,000 and the reductions will go into effect immediately. As a result of the recently completed financing survey of the various hydro systems, it has been necessary, the commission reveals, to increase rates in only sixteen municipalities out of a total of 306 served. This increase amounts only to an annual revenue of approximately $37,900.

A consolidated balance sheet of the municipalities of all systems shows that in 1932 hydro's total reserves amounted to $56,624,617. Disposition of this amount is indicated as follows: For depreciation $14,902,177; other reserves, $1,902,308; debentures, paid, $15,244,778; local sinking fund, $9,099,210, and operating surplus, $15,476,142. The total plant value of all local systems amounts to $89,887,049.

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Britain Gets Big Contract

Polish authorities have awarded to British manufacturers the contract for the electrification of the Warsaw Railway. Involved is £2,000,000 of equipment. The system has adopted 3,000 volts, d.c.

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50 per Cent for Taxes

In a newspaper advertisement to customers of the Puget Sound Power & Light Company J. F. McLaughlin, president, has made some interesting tax-menace statements. The company's tax bill for 1933 will be about $1,600,000, and for 1934 it will be close to $2,000,000, or almost double what it was in 1932. The increase of $1,000,000 in two years is almost equivalent to a 10 per cent reduction in all rates for electric service and about equal to local preferred dividend requirements. "We now have to pay more than thirty different kinds of taxes," stated Mr. McLaughlin. "In the aggregate they amount to about 50 per cent of our operating pay roll."

Oil-Blast Fuse Serves on 132-Kw. Transformers

Fuses operating upon the principle of the oil-blast explosion type circuit breakers have, according to the *Engineer* (England), been developed by the British Thomson Houston Company and installed by the Central Electricity Board in 132-kv. transformer service at the Kirkcaldy "grid" substation. They are said to be prepared to handle 500,000 kva. interruptions without distress.

The device consists of a porcelain shell, covered at the bottom by a steel plate to which a molded bakelized paper explosion chamber is bolted face downward. The plate also carries the stationary contact and a magazine, below it, to accommodate twelve blown fuse caps, while at the top of the porcelain bushing there is a hood which contains a compression spring and which forms a guide for the moving contact rod. The fuse itself consists of a copper wire inside a glass tube with ferrules at each end. One end is screwed into the contact rod while the other end engages with the stationary contact, which is of the spring collet type designed to hold the rod against the opening spring. The bushing shell is about half filled with oil to a level just above the top of the explosion chamber.

When the copper fuse wire blows the glass is shattered, the rod released and raised at a speed of about 25 ft. per second by the compression spring, while the arc drawn between the stationary contact and retreating rod contact is primarily intended to protect lines against shut-downs in the event of transformer failures. Short circuits, representing about ten times full load, are cleared, but the fuses will not blow on the occurrence of a low-tension fault, which must be cleared by the low-voltage circuit breaker.

For 132 kv., 66 kv. and possibly 33 kv. these oil-blast fuses are cheaper than the equivalent oil circuit breaker. Other advantages claimed are that the operation is so rapid that the overhead line protective gear is not affected by transformer faults, and that for the same reason the stability of the system is not impaired. On the other hand, it is impracticable to arrange for automatic reclosing, and it also takes appreciably longer to reload the fuse than it does to reclose an oil circuit breaker. For these reasons the application of the oil-blast fuse is being confined to relatively small transformers.

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Seattle Pleads for Funds

Direct appeal to Secretary of the Interior Harold N. Ickes for quick action on Seattle City Light's application for $18,500,000 to finance a development program at the Skagit has been made by Mayor John F. Dore and members of the City Council. Backing up the plea, Gov. Clarence D. Martin, State Treasurer Otto Case, State Auditor Cliff Yelle, Secretary of State E. N. Hutchinson, Land Commissioner A. C. Martin and civic organizations and city officials of Tacoma and Bellingham have sent similar telegrams to Secretary Ickes urging that the big project be immediately approved. Immediate need of a work program to prevent a serious condition in relief work in the county is urged. The loan asked is for the purpose of completing the Diablo power plant, constructing a dam at Ruby and clearing the Ruby reservoir site, projects that would give immediate employment to more than 2,000 men.

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New York Metal Prices

	Aug. 8, 1933 Cents per Pound	Aug. 15, 1933 Cents per Pound
Copper, electrolytic	9.00	9.00
Lead, Am. S. & R. price	4.50	4.50
Antimony	7.25	7.10
Nickel ingot	35.00	35.00
Zinc, spot	5.35	5.35
Tin, Straits	44.55	44.10
Aluminum, 99 per cent	23.30	23.30

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Cable Standard Approved

Standard specifications for code rubber insulation for wires and cables for general purposes have been approved by the American Standards Association (C8.11-1933). They include workmanship, properties, measurements and tests.

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Delinquent Electrical Accounts

(National Electrical Credit Association)

Number of Accounts Reported

Division	July 1932	July 1933	Per Cent Inc. or Dec.	Seven Months 1932	Seven Months 1933	Per Cent Inc. or Dec.
New York	239	87	—63.6	1,698	1,087	—36.0
Middle and Southern Atlantic	143	44	—69.2	795	390	—50.9
New England	84	49	—41.7	761	440	—42.2
Central	372	160	—57.0	3,363	1,868	—44.5
Total	838	340	—59.4	6,617	3,785	—42.8

Total Amounts Reported

New York	$14,511	$6,267	—56.8	$157,735	$73,465	—53.4
Middle and Southern Atlantic	9,507	2,581	—72.9	72,797	22,446	—69.2
New England	8,009	2,709	—66.2	57,842	26,598	—54.0
Central	24,056	10,197	—57.6	250,257	112,460	—55.1
Total	$56,083	$21,754	—61.2	$538,631	$234,967	—56.4

Major New Construction This Week

Transformers, substation equipment, pumps, motors, conveyors, etc., will be purchased for new plant of Ethyl-Dow Chemical Company, Kure Beach, Wilmington, N. C. A $2,000,000 project.

Until September 12, Bureau of Reclamation, Denver, Colo., asks bids for two 3,500-hp. horizontal-shaft, double-overhung, impulse-type, hydraulic turbines, complete with auxiliary equipment, also for two 3,000-kva., a.c. generators for Boulder power plant, Boulder City, Nev. (Specification 545).

Cereal Products Refining Company, Los Angeles, Calif., plans multi-unit brewing plant at Vernon, Calif. Cost over $250,000.

East Liverpool, Ohio, plans city-owned electric light and power plant. Cost over $1,000,000.

Department of Interior, Washington, D. C., has secured an appropriation of $460,000 for steam-electric power plant at Howard University.

Southern States Breweries, Inc., recently organized, will erect a plant at Knoxville, Tenn., to cost over $250,000.

Transformers, motors, conveyors, etc., will be installed by Mojave Smelting Company, Reno, Nev., at mining properties at Mojave, Calif. Cost about $225,000.

Department of Commerce, Bureau of Lighthouses, Washington, D. C., has secured appropriation of $95,850 for new lighting facilities at different points in Florida.

H. W. Rickel & Company, Detroit, Mich., have approved plans for multi-story brewery addition to cost about $115,000.

At special election, Grundy Center, Iowa, has authorized fund of $120,000 for new city-owned electric light and power plant.

Pay Rise at Schenectady

Employees of the General Electric Company at Schenectady, N. Y., received a flat increase of 10 per cent in wages this week. The increase will include piece rate, hourly wage and salaries up to and including $2,500 a year. It is understood that the increase will also be given to most of the office and clerical workers. The increase is in addition to a 5 per cent rise which went into effect July 1. Total amount of increases paid by the company is at the rate of $8,000,000 per year, affecting more than 42,000 employees.

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Yale Takes Walker Vehicle

Yale & Towne Manufacturing Company has purchased the real estate, machinery, tools, inventory, patents and good will of the Walker Vehicle Company and the Automatic Transportation Company, makers of electric trucks and commercial electric vehicles.

As to Rates—

• Alabama Public Service Commission has indicated its intention to hand down a decision in its investigation of the fairness of the Alabama Power Company's rates and charges before September 1. This announcement was made to Mayor W. W. Ramsey of Russellville, president of the Alabama League of Municipalities, with the comment that the task of reaching a decision is a much greater one than that presented in the Birmingham Electric Company investigation. Agitation for municipal operation of the local utilities continued in Birmingham last week when candidates for the city commission all stressed the municipal ownership issue in their campaign addresses.

• Delaware Power & Light Company charges for electricity and gas in Wilmington will be investigated in the near future, according to a decision reached last week at a meeting between Mayor Speer, City Council and the Board of Public Utility Commissioners. Maintaining that Wilmington is paying approximately 47½ per cent more for electricity and gas than Chester or Philadelphia, members of the Council demanded immediate action to the end that electric and gas rates be lowered. L. L. Hoopes, president of the board, placed the cost of an exhaustive investigation at $75,000.

• New Jersey Power & Light Company, affiliate of the Associated Gas & Electric Company, will be asked for a reduction in electric rates by consumers in Morris, Hunterdon and Warren counties.

• Jersey Central Power & Light Company has filed a revised rate schedule with the State Public Utilities Commission, designed to become effective September 1. The announced purpose of the revision is to bring about unification and standardization of rates in all the territory served by the company, and particularly that acquired from the Eastern Power & Light Company. As estimated by the company, the new schedule will result in a reduction of approximately $53,000 a year in revenue. The new rates would be applicable to all classes of service furnished by the company. The practical effect of the new schedule will be made the subject of a study by experts for the commission.

• Ohio Edison Company's revised schedule of residential and commercial lighting rates for Youngstown and certain surrounding communities (ELECTRICAL WORLD, July 22, page 104) has been approved by the State Utilities Commission.

• In the case of the city of Scottsbluff, Neb., against the Western Public Service Company, Herman Aye of Omaha, special master in chancery, has been told by H. H. Hennington, Omaha engineer and principal representative of the company, that its property is valued at $840,000, whereas Robert Fulton, Lincoln engineer, representing the city, fixes the valuation at $228,000. Judge Aye requested that briefs be filed, the figures being too far apart to render any decision. During the trial the city has been enjoined from enforcing lower rates.

Lehman Asks Aid in Utility Program

• Calling upon the state conference of mayors to support his public utilities program now before the Legislature as a means of hastening the reduction of gas and electricity rates throughout the state, Governor Lehman has asked particularly for support in bringing about the enactment of his bill to make utilities pay part of the cost of rate investigations, such as those now before the commission. Milo R. Maltbie, chairman of the Public Service Commission, commenting on the Governor's program, said: "I understand that strong influences of a utility source are at work in both parties to prevent the passage of the Governor's utility program, particularly the bill which would enable the Public Service Commission to make the utilities pay the costs of investigations of their rates, services and capitalizations. Consumers throughout the state should understand that unless funds are made available for thorough and complete investigations directed by the commission it will be impossible for the commission to dispose of the scores of complaints now pending."

Hearings before the state Public Service Commission on earnings of the electric utility companies in the New York City and suburban areas as a basis for temporary emergency rate reductions were completed last week. At the closing session on the Consolidated group Jacob H. Goetz, attorney for the utilities, made a motion that the proceedings be dismissed, holding that it had not been shown by sufficiently competent evidence that the public interest required a change in rates or that such change is necessary for any of the purposes set forth in the public service law. He held also that the evidence had not shown the present rates to be unjust, unreasonable or in anywise in violation of any provision of law, or that any decrease in such present rates is justified. He further contended that the investigation was not in accordance with the law covering the power of the commission to decrease rates and that the proceeding had been "arbitrary and in violation of the companies' rights to due process of law and the equal protection of the laws."

Milo R. Maltbie, chairman of the commission, ruled out testimony intended to show the possible effect of the blanket code of the National Industrial Recovery Act on the operating expenses of the Staten Island Edison Corporation, the last company whose testimony was heard. E. B. Naylor, attorney for the company, however, introduced testimony as to the indirect effect on the operating expenses of his company through the adoption of codes by other industries. Charts were explained showing that electric bills for residential consumers of the Staten Island company were only 73 per cent of the 1926 bills. G. L. Ohrstrom, investment banker, testified the company should show a return of 10 per cent on its property to encourage new capital.

An examination into the fixed capital and expense accounts of the Yonkers Electric Light & Power Company was conducted at the hearing into the rates of that utility. This hearing was adjourned to September 12.

A brief in which New York city asked an immediate temporary reduction in electric light and gas rates was filed this week with the Public Service Commission by Corporation Counsel Hilly. Evidence adduced at the hearings, the city contends, shows that temporary cuts pending the final decision of the commission are justified. "In view of the steady increase in electrical output for 1933 and compared to 1932," the brief read in part, "which has been taking place for several months past and which is a country-wide condition, as evidenced by the published reports of increases in the output of electrical energy, we are safe in assuming that the total output of electrical energy for these companies will be higher in 1933 than in 1932, and furthermore that the unit cost of this energy will, on the whole, be lower in 1933 than it was in 1932. This assumption is further fortified by the testimony of the companies' witnesses as to the reduction in the price of coal and the reductions in salaries and wages which were effective May 1, 1933. These increases in sales and decreases in cost of material and labor will justify the commission in making an immediate and substantial decrease in rates."

• La Porte Gas & Electric Company will reduce its electric rates substantially according to an announcement made by Sherman Minton, public counselor for the Indiana Public Service Commission, after conferences with officials of the company. Domestic consumers will receive a cut of approximately 12 per cent and commercial customers of 10 per cent.

• Columbus Railway, Power & Light Company's lowering of the rate for electricity used by Columbus homes and businesses will not mean an increase in street car fare in that city, John M. Lewis, president of City Council, said last week. His statement was made when the Council acceded to the demand of Ben W. Marr, president of the Co-

lumbus utility, that J. Paul Blundon, expert appointed to study the company's costs and profits (ELECTRICAL WORLD, August 12, page 200), include in his examination operations of the Rail-Light's street car operations as well as its electric current business.

• Eastern Washington irrigation power rates, under discussion for some time (ELECTRICAL WORLD, July 8, page 35), have been ordered reduced 10 to 35 per cent temporarily and private power companies given renewed warning to beware of shortsightedness in an order recently issued by the state Department of Public Works. The temporary reduction ordered applies only to the 1933 rates for irrigation power and spray service. The three companies involved, the Puget Sound Power & Light Company, Washington Water Power Company and Pacific Power & Light Company, were also ordered to eliminate existing rate structures for these classes of service, substituting the so-called California rate structure, beginning with the 1934 irrigation season. The reductions in 1933 rates were made retroactive to May 5.

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Memorial Dedicated to Edison

Dedicated to the founder of the first electric company in New York City, a life-size bronze bust of the late Thomas A. Edison was placed last week in a niche in the main hall of the Consolidated Gas Company building.

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Tillamook Power Voted

For the second time in two years the people of Tillamook County have approved a proposal to create a people's power district. At a recent election the proposal was approved by a vote of more than two to one. This will be the first power district to be organized under authority of an act passed by the Legislature in 1931.

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Wild Legislation in New York

Under the provisions of a drastic bill introduced before the extraordinary session of the New York Legislature by Assemblyman Moran every person, firm and corporation engaged in the sale of gas, electricity, steam and water to the public would be required to file with the Public Service Commission a new tariff showing a reduction of 30 per cent below the present rates and charges. Failure to comply would subject the offending utility to a fine of $1,000 per day for each day the failure continues and any utility failing to file for a period of 60 days would have its certificate of convenience and necessity canceled, and, if a corporation, would be dissolved by the Supreme Court on application of the Attorney-General.

Municipal Items

CŒUR D'ALENE, IDAHO—After a rehearing the state Supreme Court has again denied this city authority to purchase a municipal power and water plant out of revenues to be received from their operation. The court in a decision rendered last winter denied the city authority to make the proposed purchase, permission for which has been sought for a number of years. The City Council then initiated ordinances which were passed providing for purchase of a power plant and a water system, with a provision that revenue from their operation would pay for their cost. Suit for an injunction was brought against the officials, objectors contending that purchase of the plants was in violation of the constitution prohibiting pledging of more than one year's revenues of the city without approval of the qualified electors of the city.

FORTVILLE, IND.—Officials have consulted engineers and inspected municipal electric plants in other localities with a view to the establishment of a local municipal plant. Dissatisfaction has been expressed with the rates charged under private ownership.

TIPTON, IND.—City Council has voted to install a municipal lighting plant at an estimated cost of $180,000. Engineers, estimating the cost of construction, have reported to the Council that a recent decision, known as the Oxford decision, held that a debt for a municipal plant to be paid out of earnings did not affect the constitutional limit of indebtedness of a municipality. The Indiana law limits such indebtedness to 2 per cent.

NEW ALBANY, IND.—Petition asking the City Council to call a special election on the public ownership of electric and gas utilities has been filed by the Consumers' League of New Albany. Purchase of the property of the Public Service Company of Indiana is asked. The petition is the second filed by the league, the first having been declared invalid by the city legal department.

SALEM, MO.—Contract entered into by the city for the purchase of engines, generators, swtichboard and other equipment for a municipal light and power plant with the net revenues of the plant has been declared invalid by Jefferson City, Mo., division No. 1 of the Missouri Supreme Court. The high court ruled that the contract violated constitutional provisions limiting the indebtedness a municipality may contract. A provision of the contract was that the $60,944 purchase price was not to be a general obligation of the city and was not to be paid out of general revenue or city tax funds, but to be financed only out of the net earnings of the plant over a period of six years. Notwithstanding these legal safeguards to avoid the constitutionality restrictions as to contracting debts beyond a certain limit, the high court made the contract void because it contained a clause that the city should pay for current used on the city streets, in a municipal water works and for other municipal purposes until such time as the purchase price had been paid in full. The court stated that the provision called for payments out of city funds raised through taxation and thus made the constitutional restrictions applicable to the contract.

KENNETT, MO.—By a vote of 1,333 to 58, citizens have approved the issuance of $140,000 in bonds to finance the construction of a municipal light and power plant. The city is now served by the Arkansas-Missouri Power Company under a franchise that does not expire until 1935. Mayor Paul C. Jones has announced that the city will offer to purchase the distribution system of the power company for a reasonable price and that construction of the plant will be started as soon as the bonds can be sold.

CORAOPOLIS, PA.—Following the study undertaken by Peter Loftus, Pittsburgh consulting engineer (ELECTRICAL WORLD, August 5, page 169), the Borough Council unanimously passed a resolution to take over the street lighting system. Bids on the installation of poles and lines for the lighting of its streets will be opened by the borough in a few weeks. Inability to effect economies in the lighting by reason of a contract with the Duquesne Light Company resulted in the study of resuming lighting the streets by the borough. The equipment will cost about $70,000. Borough Solicitor Hofacker said that the system should pay for itself in fifteen years. The borough furnished all its own light for municipal purposes as well as individual use until 1927, when the system was sold to the Duquesne utility. The street lighting contract expired last fall.

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St. Louis Rehearing Denial

Motion of the Union Electric Light & Power Company for a rehearing of the case in which it sought to acquire and hold 26 per cent of the stock of its business rival, the Laclede Power & Light Company (ELECTRICAL WORLD, June 24, page 814), has been overruled by Division No. 1 of the Missouri Supreme Court. On June 12 last the high court upheld a ruling of the Missouri Public Service Commission refusing to allow the stock purchase. Division No. 1 also rejected the request of the power company that the case be transferred to the Supreme Court *en banc*.

EDITORIALS

L.W.W.MORROW
Editor

Make utility code an effective recovery aid

NOWHERE is there evident in the electric utility industry anything but desire to cooperate in every practical way to assure industrial recovery. Utilities have all along been a remarkable stabilizing influence. Wages and staffs of the operating companies have hardly been reduced at all by comparison with the manufacturing industry. It is not strange that the industry should be expected by some, especially the NRA, to record its eagerness to conform to the national recovery drive. That is the background for the filing of the code reported in these columns last week and again in modified form this week.

But is a code really necessary or desirable? In so far as the codes are codes of fair competition they may be utterly inapplicable to utilities, for which state regulation long ago superseded uneconomical competition. In so far as they are wage and hour codes the utilities with minor adjustments can readily give public evidence of conformity. In so far as the codes are the recorded assurance of trade associations they are foreign to Edison Electric Institute, which was understood by many at its inception to have disavowed such a province for itself. A code for the electrical utility industry seems to be justifiable only to show that that industry is by document as aware of its responsibility in aiding recovery as it has been by a multiplicity of acts as to wages, spread work, power rates, local relief work, extended credit to customers, etc.

Objections to the filing of any code have been voiced most lucidly by Messrs. Wagner and Ferguson, whose companies have tendered their resignations as members of the institute rather than be parties to an industry code. They believe a serious mistake has been made in conceding utilities to be "codable." Quite apart from the implied conflict between state and federal authority, one must ask what would happen if the administration should refuse to license a utility that failed to subscribe to the code submitted by the representative association of the industry? These utilities have charters, franchises and certificates of convenience and necessity which subject them to regulation of their rates, earnings and allowed expenditures. No other physical agency could possibly replace their service if it were suspended. Would punctilious refusal, on the one side, to sign a code or, on the other side, refusal to grant a license mean federal management, or would it, as in the case of industrial units which might out of pure selfishness refuse to adhere, mean a padlocked plant?

NRA should not have required a code of the electric utilities. Maybe it was so decreed rather than begin exemptions, least of all with the utilities, which had been brought so much into the public eye during the political campaign and still are so. With the code filed (and not away in a file) the course of wisdom is to make the best of it in the interest of national recovery, hoping that it will lead neither to vicious legal entanglements nor to disruption of an institute conceived so conscientiously and initiated so auspiciously as a truly representative organization with a unique code of business ethics.

Analyzing industrial modernization problems

BEFORE us lies a plan for the electrical modernization of a large steel plant prepared sufficiently in advance of the depression to enable the necessary steps to be taken in the betterment program. The cost data are of relatively little value now, but the procedure followed is most timely today. The plant embraced three groups of mills in a single city, divided in general into hot rolling and finishing departments. Prior to electrification the combined steam-generating facilities of the company totaled 66 boilers, and power was furnished by 16,200 hp. in steam engines, several steam-driven electric generators and 4,000 kw. in purchased energy. Much of the mill machinery was two or more decades old, and a definite replacement policy was becoming a major problem.

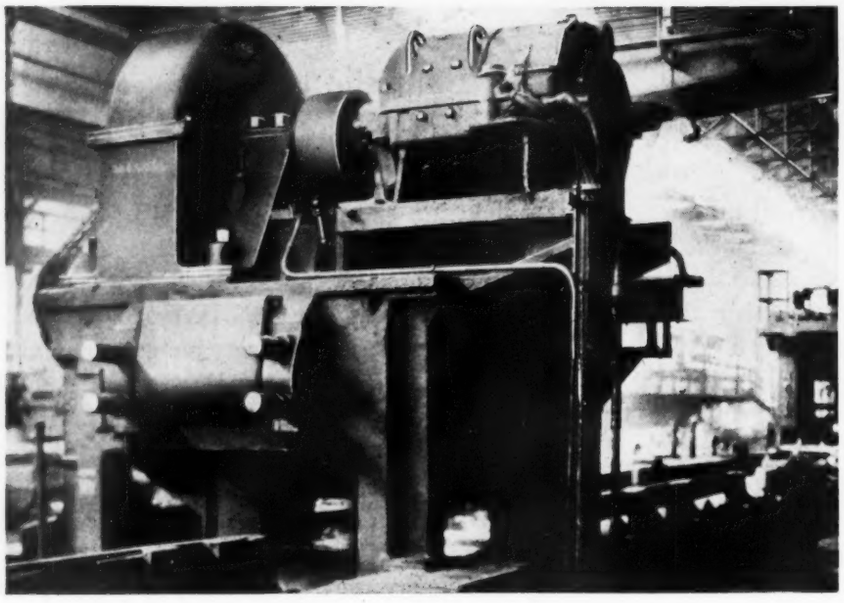
A survey indicated that four plans were available for modernization: First, to replace the power equipment as fast as it wore out, using other equipment of as nearly the same size and type as feasible; second, replacement of the existing power equipment by a central generating station with complete electrification of all departments; third, abandonment of all existing power equipment and the purchase of all energy, this involving complete motorization of the mills; fourth, electrification of the finishing departments only, and the purchase of sufficient energy to supply the motors driving these departments in addition to the then existing demand.

The first plan was inadvisable from both engineering and operating standpoints. Plan 2 appealed to the management except on the ground of first cost, about $9,000,000. The third plan likewise involved heavy investment outlays. Plan 4, which was adopted, required an investment of about $350,000 to handle about 40 per cent of the load requirements of the mills, and appeared fitted to the then uncertainties of price trends in labor, fuel, material and transportation, besides reducing the existing load on the power-generating equipment to a degree permitting the abandonment of the oldest and poorest apparatus, with notable savings in fuel and labor and improvement in motor drives. The success of the work led to complete motorization of the entire group of mills later and adoption of purchased power throughout.

Over-all domestic use a sufficient rate basis

SHOULD the energy consumption of different household appliances be accurately known as a basis for promotional rates? This query was raised at a recent rate hearing in the Marlboro (Mass.) Electric Company case and was answered in the negative by J. E. Gray, rate engineer of the New England Power System, which operates this utility. The opposition tried to make capital out of the admission that central stations have no definite information as to the energy consumption absorbed in any particular residence by the customer's individual appliances, but was unable to show that promotional rates based on over-all consumption were illogical. Many tests have been made to give the industry a rough idea of the average use of electricity which may be expected from different appliances, it is true, but the data resulting from these investigations do not reveal the habits and usages of particular customers and were not so intended.

The Connecticut commission has recently shown how effectively domestic rates can be adapted to different over-all consumptions in a supplemental order applying to the Northern Connecticut Power Company. Customers having a "limited use" of electricity (as defined in the schedule) receive an energy charge of 3.4 cents per kilowatt-hour for all electricity in excess of 20 kw.-hr. per month. For "partial service" residential users a 2.5-cent rate applies above 100 kw.-hr. per month, and for "full use" household service the rate is 1.5 cents above 300 kw.-hr. per month. Other variants are provided in the area charge. Apart from the effect of these rates on the revenue (the company feels that increasing taxation imposes an undue hazard upon the rate base return figured), the recognition of the value of increasing usage of service given by the order is a clear indication that over-all consumption rather than the energy absorption of individual appliances suffices for the rate-builder. Should demands of individual residences or groups become too great for good voltage regulation, steps would of course have to be taken to remedy the situation, but for the present, at least, the necessity for delving deeply into the performance of individual appliance units would seem to be academic as far as establishing fair promotional rates is concerned.



Compound motor on a sheet, bar and billet mill. Crop shear (350 tons) driven by G. E. type MD-420-AE-2, 200-hp., 425-r.p.m., 230-volt d.c. compounded mill motor. Illustration shows entering side of 21-in. continuous mill

By T. R. RHEA

Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

Motor Duty Cycles Computed by New Method

APPLICATION engineers are frequently called upon to apply a motor to a machine which must be started, stopped and perhaps reversed frequently. A motor with certain characteristics must be selected and from these characteristics and the characteristics of the machine to be driven the performance of the motor must be calculated. The application engineer must determine the time necessary to accelerate and decelerate, the revolutions required to accelerate and decelerate and the root-mean-square load, to determine if the motor has ample thermal capacity to carry such a load. Among the very common machines where such calculations are necessary are:

shears
live tables on reversing blooming mills
automatic sheet and tin plate catchers
railway motors
mine hoists
shovels
elevators
coal and ore bridges
car dumpers
cable ways
car pullers
cranes
skip hoists
special machine tools
centrifugal extractors and centrifugal pumps, etc.

In fact, any new machine involving the starting and stopping of inertia requires a duty cycle calculation to determine the operating characteristics of the system.

For example, when applying a d.c. motor to a rotary shear which must start and stop for each cut it is necessary to calculate the motor performance when applied to this shear to make sure that the motor has sufficient torque to accelerate the shear up to a given speed in a given number of revolutions, make the cut and then slow down and stop before the knives go through the metal again. After this has been determined it is necessary to determine if the motor has sufficient continuous load capacity to start and stop the shear the required number of times each minute.

On automatic sheet and tin plate catcher motor applications the number of revolutions required to get up to speed is not particularly important, but what amounts to the same thing, the acceleration rate permissible to keep the metal from slipping on the tables is very important, and this must be determined for such applications.

In order to make recommendation on the size and type of motor to be applied to a given machine the application engineer should have complete information on the duty cycle which is expected. He should receive from the machine builder the time or number of revolutions permissible to get up to speed and down again. This may be translated into the number of feet of travel of the skip hoist or number of miles on the railway locomotive, but some such information is necessary. Information on the number of starts and stops per minute, the rest periods and the periods of running at full speed, together with the friction or other dead loads on the motor, is essential. One of the most important bits of information required and the item which is usually omitted is the WR^2 or inertia of the machine

Table I—Characteristics of MD Mill Type Series Motors, 1-Hour, 75 Deg. C., 230 Volt

MD Frame	Hp.	Full Load Speed	Full Load Torque	Full Load Amp.	Armature WR^2	Torque Max. Starting	Torque Max. Running
402.....	5	900	29	21	2.2	146	116
403.....	7½	800	49	31	4.0	246	196
404.....	10	725	72	40	4.8	363	288
406.....	15	650	121	59	9.5	605	484
408.....	25	575	228	95	26.2	1,140	912
410.....	35	525	350	132	40.2	1,750	1,400
412.....	50	500	525	185	69.5	2,625	2,100
414.....	75	475	830	275	118	4,150	3,320
416.....	100	460	1,140	360	209	5,700	4,560
418.....	150	450	1,750	535	415	8,750	7,000
420.....	200	410	2,560	710	800	12,500	8,500

to be driven. If the machine is an entirely new one a diagrammatic sketch of how the machine operates is worth ten pages of descriptive matter to the application engineer.

The application engineer has on hand characteristics and speed-torque curves for a.c. squirrel-cage and wound-rotor motors and for d.c. series, compound and shunt-wound motors. He knows how these speed-torque curves and other characteristics are affected by the control equipment. These combined characteristics must be used in determining what a given motor will do when applied to a given machine. Judgment and experience aid him in selecting the size and type of motor initially, but after such a selection is made then a speed-time calculation must be made to determine whether or not the motor meets the specified duty cycle.

Old method is laborious

After selecting a motor with certain definite speed-torque characteristics it is a matter of straight calculation to determine the time of acceleration, deceleration, dynamic braking or plugging, the number of revolutions made and the root-mean-square heating. The usual speed-time calculation is a step-by-step procedure, based upon the fundamental relationship between torque, WR^2 and acceleration rates shown later in formula 1. It is not the purpose of this article to describe these step-by-step calculations, since nearly every application engineer makes them as a matter of course.

Such a step-by-step calculation consists of taking the motor speed-torque characteristic, as modified by the control, plotted in terms of pounds-feet versus r.p.m., and then considering the torque to be constant over small increments of speed, in this way building up a speed-time curve, which is a function of the WR^2 and the friction torque. After this rather laborious calculation is made, if it turns out that the motor will not accelerate the load in the required length of time or the required number of revolutions, either a new motor is selected or the gear ratio is changed between the motor and the WR^2 to be accelerated.* When this change is made another rather laborious step-by-step calculation is entered into to determine the operation.

New method uses per unit values for motors

This article contains three ideas, none of them new or original, but the author does not recall seeing them in print. They are:

1. A line of motors having similar characteristics can be very conveniently plotted in per unit values. (Per unit values are simply percentage values with the useless factor, 100, left out.)

*"*Steel Mill Auxiliary Drive,*" by L. A. Umansky, General Electric Review, November, 1922.*

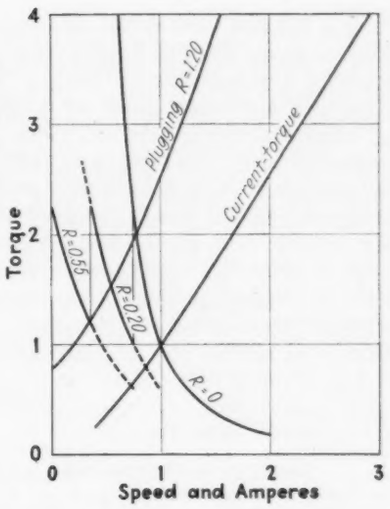


Fig. 1—Whole line of series mill motors reduced to unit basis

Curves show MD402 to MD420 motors (5 to 200 hp.) 230 volt, one-hour, 75 deg. C. on single set of curves. Effect of starting resistors included.

By this means one set of characteristic curves plotted in per unit values will represent the entire line of motors.

2. The time required to accelerate to a given speed is proportional to the total WR^2 and the area under the reciprocal of the speed-torque curve. This is another way of saying that the acceleration rate is proportional to the torque. This relationship is a very useful one and forms the basis for this article. This is dealt with in some detail later.

3. If the speed-torque characteristics of a line of motors are plotted in per unit values, and the reciprocal of the speed-torque curve plotted therefrom by a step-by-step calculation, *this work need be done only once* for the entire line of motors and no further step-by-step calculations made, no matter what the gear ratio, WR^2 or friction load applied to any one of these motors.

Let us now consider the above three ideas somewhat more in detail. A convenient example of such a line of motors is the type MD mill type series motors, 1 hour rated, 75 deg. C., 230 volt. As shown in Table I, these motors have horsepower ratings from 5 to 200 hp. and a normal full-load speed rating from 900 down to 410 r.p.m. However, these motors are so designed that their *speed-torque characteristics when plotted in per unit values are identical* to all practical purposes. The speed-torque characteristics of this line of motor are shown in Fig. 1.

Starting resistance taken into account

In Fig. 1 is shown not only the fundamental speed-torque curve of the series motor when operating directly across 230 volts ($R = 0$), but also portions of the speed-torque curve that will be obtained with various amounts of resistance in series. This is exactly the case when the motor is started by means of magnetic control. The section $R = 0.55$ shows the speed-torque curve that will be obtained with this amount of resistance in series.

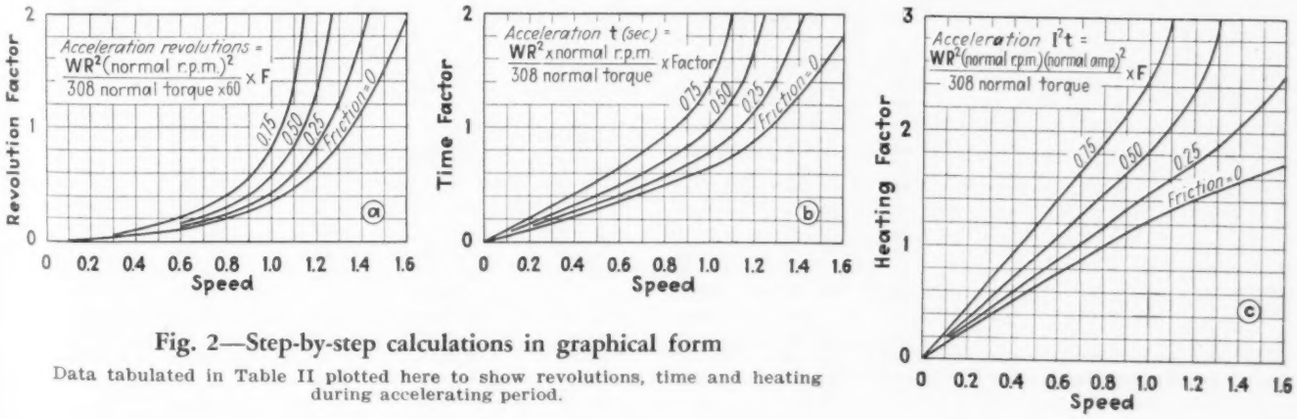


Fig. 2—Step-by-step calculations in graphical form

Data tabulated in Table II plotted here to show revolutions, time and heating during accelerating period.

After a certain time delay this resistance is reduced to 0.2, and then, after a certain additional time delay, the motor is thrown directly across the line. Therefore, in making any calculations of a speed-time curve, it is the complete motor characteristic combined with the magnetic control characteristic that must be considered. The resistance values indicated are per unit values and correspond to the usual standard arrangement of magnetic control for steel mill auxiliaries. On the same curve is shown a speed-torque characteristic when the motor is plugged through a resistance ($R = 1.2$). The torque-current curve for this line of motors is also included. It should be understood that the curves shown on Fig. 1 cover the entire line of series motors. Only the normal values of current, torque and speed change as shown in Table I.

Curve area determines time to accelerate

The second idea outlined above is that the *time to accelerate to a given speed is proportional to the total WR^2 and the area under the reciprocal of the speed-torque curve.*

The fundamental relationship between torque and acceleration rate is:

$$T = \frac{WR^2 a}{308} \qquad (1)$$

where T = net accelerating torque in lb.-ft.
WR^2 = inertia in lb.-ft.^{2}
a = acceleration rate in r.p.m. per second.

Acceleration is more conveniently expressed as $\frac{\Delta t}{\Delta S}$ and equation (1) written as:

$$\Delta t = \frac{WR^2}{308} \frac{\Delta S}{\Delta T} \qquad (2)$$

In words, equation (2) says that the increment of time in seconds to accelerate the WR^2 through an increment of speed, S, is inversely proportional to the net accelerating torque. Note that it is the inverse of the *net* accelerating torque, and if friction or other dead load is present, it must be subtracted from or added to the motor torque, before the reciprocal is taken.

Since the speed-torque curve of the motor is to be plotted in per unit values, it is convenient to write equation (2) in terms of per unit values, thus:

$$\Delta t = \frac{WR^2}{308} \frac{(S_N)}{T_N} \frac{\Delta s}{T_M \pm T_F} \qquad (3)$$

where WR^2 = total WR^2 motor armature and machine WR^2 referred to motor shaft in lb.-ft.^{2}.
S_N = normal speed in r.p.m.
T_N = normal motor torque in lb.-ft.
T_M = motor torque at any speed, as a decimal of normal motor torque (i.e. per unit value).
s = motor speed as a decimal of normal motor speed.
T_F = friction torque at any speed, as a decimal of normal motor torque.

The use of the plus or minus sign depends on whether the friction torque aids or opposes the motor torque. It is usually minus when accelerating, positive when plugging or dynamic braking.

Best to tabulate calculations

Table II shows the step-by-step calculation of equation (3), leaving out the constant terms of WR^2, normal speed and normal torque. This is the usual step-by-step calculation made by the application engineer *except that it is now in per unit values* and the constant terms of WR^2, normal motor speed and normal motor torque are not included. Table II shows the step-by-step calculation for the acceleration speed-torque curves shown on Fig. 1. This method is sufficiently accurate as long as a small increment of speed is taken for each step. Over these small increments of speed the average torque is assumed constant. The increments of time are then added up, as shown in column 7 of Table II.

In addition to the time required to accelerate, the application engineer frequently requires the number of revolutions made by a motor to get up to speed or down again. The number of revolutions made in any increment of time (equation 3) is determined by multiplying the increment of time by the average speed existing in that interval of time. Therefore, the increment of revolutions made in any increment of time is:

$$\Delta \text{ Revolutions} = \frac{WR^2 (S_N)^2}{308\ T_N\ 60} \frac{s\ \Delta s}{T_M \pm T_N} \qquad (4)$$

In addition to the time and number of revolutions, as represented by equations (3) and (4), the heating of the motor is also needed during the period of acceleration and deceleration. Since this heating is proportional to the square of the current and the increment of time, it is only necessary to multiply equation (3) by the square of the current. This relation is:

$$I^2 \Delta t = \frac{WR^2\ S_N\ (I_N)^2}{308\ T_N} \frac{I^2\ \Delta s}{T_M \pm T_F} \qquad (5)$$

where I_N = normal current in amperes.
I = per unit value of current at speed, s.

Table II—Step-by-Step Calculation of Acceleration Speed-Time Curves; F = 0.25; per Unit Values

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Speed	Speed Incr.	Motor Torque Acc.	Friction Torque	Motor Current	$\frac{1}{T_M - T_F}$	$\frac{\Delta s}{T_M - T_F}$	$\sum \frac{\Delta s}{T_M - T_F}$	$\frac{s\ \Delta s}{T_M - T_F}$	$\sum \frac{s\ \Delta s}{T_M - T_F}$	$\frac{I^2\ \Delta s}{T_M - T_F}$	$\sum \frac{I^2\ \Delta s}{T_M - T_F}$
s	Δs	T_M	T_F	I							
0.1	0.1	2.05	0.25	1.70	0.555	0.0555	0.0555	0.0028	0.0028	0.160	0.16
0.2	0.1	1.72	0.25	1.50	0.680	0.0680	0.1235	0.0102	0.0130	0.153	0.31
0.3	0.1	1.44	0.25	1.30	0.838	0.0838	0.2073	0.0209	0.0339	0.142	0.45
0.4	0.1	1.60	0.25	1.42	0.740	0.0740	0.2813	0.0259	0.0598	0.149	0.60
0.5	0.1	1.90	0.25	1.60	0.605	0.0605	0.3418	0.0272	0.0870	0.155	0.76
0.6	0.1	1.55	0.25	1.38	0.769	0.0769	0.4187	0.0423	0.1293	0.146	0.90
0.7	0.1	1.22	0.25	1.15	1.030	0.1030	0.5217	0.0670	0.1960	0.136	1.04
0.8	0.1	1.60	0.25	1.41	0.740	0.0740	0.595	0.0555	0.2515	0.146	1.18
0.9	0.1	1.64	0.25	1.44	0.720	0.0720	0.668	0.0611	0.3126	0.149	1.34
1.0	0.1	1.15	0.25	1.11	1.110	0.1110	0.779	0.1050	0.4176	0.136	1.47
1.1	0.1	0.9	0.25	0.94	1.540	0.1540	0.933	0.1620	0.580	0.135	1.61
1.2	0.1	0.72	0.25	0.80	2.130	0.2130	1.146	0.2450	0.825	0.136	1.74
1.3	0.1	0.58	0.25	0.70	3.030	0.3030	1.449	0.3800	1.205	0.148	1.89
1.4	0.1	0.48	0.25	0.60	4.350	0.4350	1.884	0.5860	1.791	0.157	2.05
1.5	0.1	0.40	0.25	0.54	6.660	0.6660	2.550	0.9650	2.756	0.194	2.24
1.6	0.1	9.35	0.25	0.50	10.00	1.0000	3.550	1.6000	4.356	0.250	2.49
1.7	0.1	0.30	0.25	0.45	20.00	2.0000	5.550	3.4000	7.756	0.404	2.90

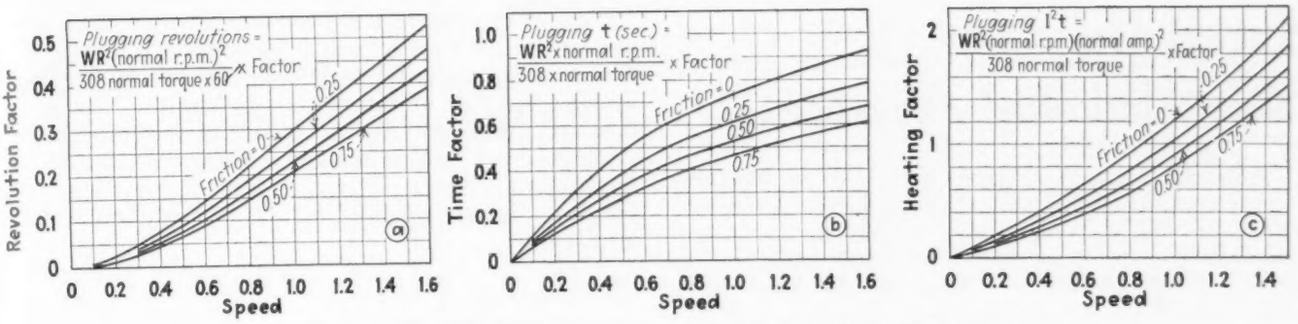

Plugging revolutions = WR²(normal r.p.m.)² / 308 normal torque x 60 × Factor
Revolution Factor
Friction = 0
0.25
0.50
0.75
Speed
Plugging t (sec) = WR² x normal r.p.m. / 308 x normal torque x Factor
Time Factor
Plugging I²t = WR²(normal rpm)(normal amp.)² / 308 normal torque xFactor
Heating Factor

Fig. 3—Retardation time, turns and heating after plugging

The results of the tabulation in Table II are plotted on Figs. 2a, which gives the revolutions during acceleration; 2b, which gives the time during acceleration, and 2c, which gives the heating during acceleration.

Table II does not include the calculations for plugging. The speed-torque curve for plugging is shown on Fig. 1 ($R = 1.2$). The calculations for plugging are of exactly the same type as for acceleration, except that the speed-torque curve for plugging is used. The results of the plugging calculations are included in Figs. 3a, 3b and 3c.

Note that the curves are plotted for several values of friction. These curves assume that the friction or the dead load is constant. Table II is the calculation when friction is 0.25, or one-quarter of normal motor torque.

Method applied to a practical problem

Suppose an MD-410-230-volt series motor, 35 hp., one hour, 75 deg. C., is to be applied to an external WR^2 of 60 lb.-ft.², referred to the motor shaft, and a friction load of 175 lb.-ft. (50 per cent). It is desired to find the time required to accelerate to top speed and plug to rest, the number of revolutions required and the root-mean-square current for the operation. The data on this motor, from Table I, are:

S_N = 525 r.p.m.
T_N = 350 lb.-ft.
WR^2 = 40.2 lb.-ft.² armature.
WR^2 = 60.0 lb.-ft.² external machine, gears, etc.
WR^2 = 100.2 lb.-ft.² total referred to motor shaft.
T_F = 175 lb.-ft. friction (0.5 per unit value).
I_N = 132 amp. normal current.

Referring to Fig. 2b, the series motor will accelerate to about 1.27 speed and, of course, will plug from that speed. The 0.5 friction curve is used.

Acceleration:

t = 1.09 seconds (Fig. 2b)
Rev. = 8.7 (Fig. 2a)
I^2t = 23,100 (Fig. 2c)

Plugging:

t = 0.300 (Fig. 3b)
Rev. = 1.39 (Fig. 3a)
I^2t = 11,300 (Fig. 3c)

The values taken from the curves have been multiplied by the proper terms of WR^2, normal torque, etc.

Hence the total time to accelerate and plug is 1.39 seconds, the number of revolutions 10.09, the root-mean-square current is (square-root of 34,400 divided by the time, 1.39 seconds), 155 amp.

In a practical case it is not quite accurate to take only the accelerating time and plugging time. Actually, there is a time delay waiting for the directional contactors to close (0.1 second), time delay (0.1 second), while the plugging relay operates and (0.1 second) time delay before the plugging contactor closes. This makes a total time lag of approximately 0.3 second after the master switch is thrown forward before the motor actually begins to accelerate on the first point, $R = 0.55$, Fig. 1. When the motor is running forward, $R = 0$, Fig. 1, and the master switch is thrown reverse to plug a time delay of approximately 0.1 second ensues to open the directional contactors forward and close them reverse. Thus, an additional time of about 0.4 second must be added to the 1.39 seconds, making a total over-all time of 1.79 seconds and an r.m.s. current of 138 amp.

Note that the 0.4 second does not include the time delay of closing the accelerating contactors to transfer from $R = 0.55$ to $R = 0.20$, to $R = 0$, Fig. 1. This amount of time is contained in the 1.39 seconds, since it is implicitly contained in the accelerating speed torque of Fig. 1. Obviously, the time of the accelerating contactors closing would have to be adjusted for each new value of WR^2 and friction torque in order to have the actual speed-torque curve correspond to the conditions of Fig. 1.

In some applications two MD motors are connected in series across 230 volts. This has the effect of reducing the normal speed to approximately one-half, but the shape of the speed-torque curve in per unit values is not changed appreciably. Therefore, the same calculations and curves may be used for this condition merely by changing the value of the normal speed to one-half. This particular condition illustrates the labor-saving artifice of plotting the motor speed-torque curves in per unit values (percentage with the factor 100 omitted).

This system of calculation may be applied to any group or line of motors, whether squirrel cage, wound rotor, series, compound or shunt. For example, any series motor whose characteristics, when reduced to per unit values, fit the speed-torque and speed-current curves of Fig. 1 will have its speed-time, speed-revolution and speed-heating characteristics accurately represented by the curves 2a, b, c and 3a, b, c. The results are not confined to type MD motors.

The author has found this method a great time-saver and a ready and convenient reference in the many duty cycle calculations required of an application engineer.

▼

Hospital Uses Refrigerator's Condenser Waste Heat

At the Ancoats Hospital, Manchester, England, advantage is being taken of the fact, usually overlooked, that a refrigerator machine supplies heat in convenient form for utilization. A methyl chloride apparatus is operated to maintain a room temperature in one part of the hospital at about freezing point, but the condenser of the machine, instead of being cooled in the open air, is inclosed in a duct through which a fan draught is provided, the effluent warm air being delivered to the linen cupboards, for drying purposes. Cost of heating thus is negligible. Cost of refrigeration and heating is proportionately lower than if both functions of the cooling machine were not utilized.

Energy Use Shows Industrial Advance

Industrial activity in July, measured by electrical energy consumption in manufacturing plants as reported to the ELECTRICAL WORLD, rose sharply for the fourth consecutive month from the low point registered in early spring. The increase over June approximated 7 per cent, over March 47 per cent and over July, 1932, 45 per cent.

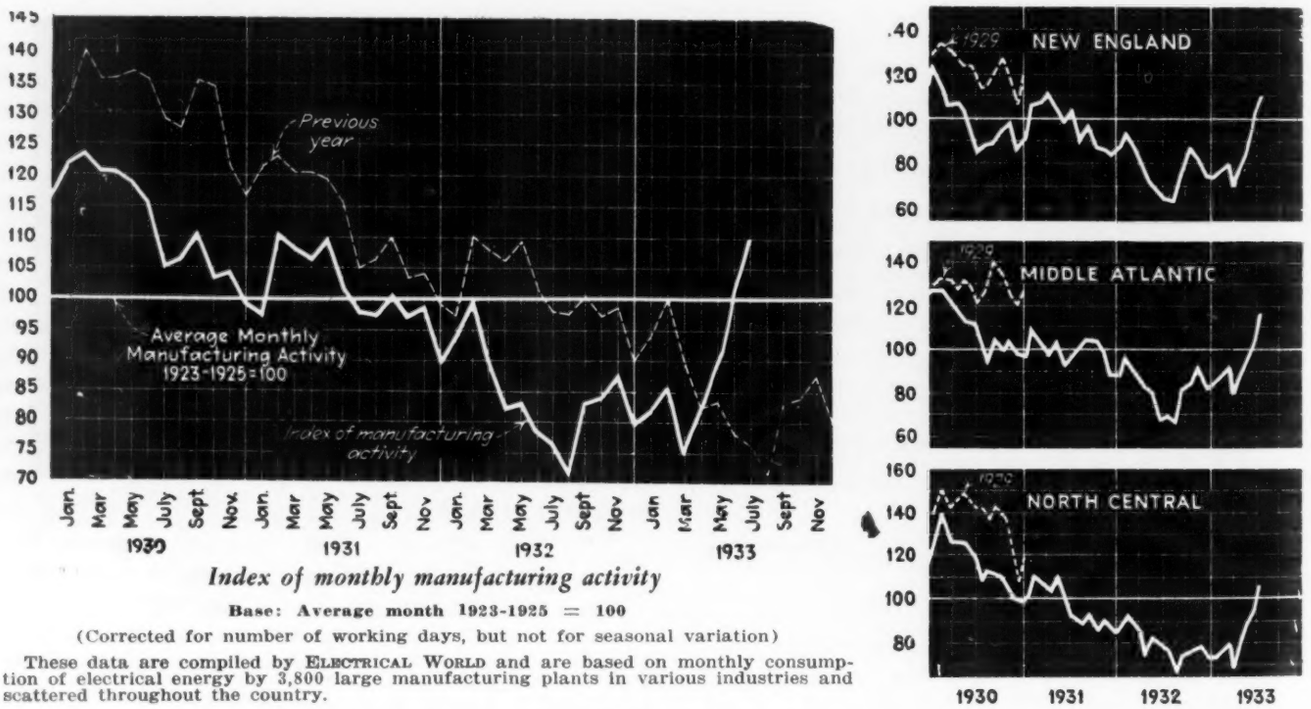
A year ago the trend was steeply downward; now it is even more steeply upward. Thus far the rise has balanced that portion of the decline which began about two years ago; the index for July is at the level of the spring months of 1931, and of September, 1930. It is well above that of July in both of those years.

As the chart shows, the index during the greater part of 1929, before the break, was around 135. Compared with that as typical of the peak period, present operations are down 18 per cent.

The advance has been nationwide, although more pronounced in the East than in other parts of the country. Evidence of this is found in a comparison of regional averages for July of both years. In both the New England and the Middle Atlantic groups of states the increment is 65 per cent, in the North Central 40, the South 47 and the West 34 per cent. Detailed index numbers for the two last-named regions will be published in next week's issue.

While changes in some industry groups greatly exceeded changes in the averages, and while in others the changes were much smaller, it is to be noted that almost without exception both the regional figures and those for the country as a whole advanced strongly compared with a year ago.

The food industry, for example, has been comparatively stable throughout the entire period of general decline and partial recovery. The year's interval shows a rise of 20 per cent for the United States as a whole and of similarly moderate gains in the several regions except the Middle Atlantic. Textiles, in contrast, rose more than 100 per cent everywhere except in the North Central area.



Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

	United States				New England				Middle Atlantic				North Central			
Industrial Groups	July, 1933	June, 1933	May, 1933	July, 1932	July, 1933	June, 1933	May, 1933	July, 1932	July, 1933	June, 1933	May, 1933	July, 1932	July, 1933	June, 1933	May, 1933	July, 1932
All Industry	**110.7**	**103.8***	**92.9**	**76.3**	**109.0**	**104.3**	**85.7**	**66.2**	**115.3**	**108.2***	**97.3**	**70.0**	**105.4**	**97.6***	**89.1**	75.4
Automobiles (including parts and accessories)	67.2	64.8*	58.9	58.0	....	....	....	....	68.7	64.0*	55.7	47.5	66.7	63.9*	59.1	57.7
Chemical products (including oil refining)	146.7	135.7*	127.1	124.9	160.7	163.0	135.1	143.4	153.8	143.0*	131.0	134.2	145.0	129.4	129.3	115.
Food products	147.2	136.0*	126.2	122.0	....	....	....	....	153.2	147.4*	129.5	99.7	146.0	131.4*	123.2	124.0
Iron and steel	91.7	79.8*	68.8	51.2	159.7	135.7	108.8	85.3	77.1	65.5*	57.0	41.3	97.8	86.8*	74.7	55.0
Metal working	78.0	72.6*	63.7	50.2	105.8	98.6	82.0	62.3	66.2	63.0*	57.2	50.8	84.5	77.5*	64.8	47.0
Metal group	83.0	75.3*	65.5	50.7	120.9	109.0	89.5	68.8	70.9	64.1*	57.1	46.8	89.5	81.0*	68.5	50.2
Leather products	101.2	100.2	93.5	73.7	96.0	90.8*	78.2	72.8	116.5	124.8*	119.4	86.0	89.7	84.4*	81.5	59.0
Forest products	103.3	94.5*	91.3	69.2	50.6	48.6*	41.0	37.2	63.5	61.7*	52.0	54.4	103.3	93.2	84.0	67.7
Paper and pulp	128.3	125.0*	112.0	94.5	128.5	116.5*	112.5	97.7	104.2	99.5*	89.2	61.8	119.5	121.0	104.4	94.7
Rubber products	157.0	137.0*	124.5	95.6	136.8	138.2	112.9	84.8	....	....	....	....	159.7	146.0*	126.3	95.
Shipbuilding	76.4	75.7	71.3	82.5	....	....	....	....	....	....	....	....	....	....	....	....
Stone, clay and glass	107.0	102.0*	90.0	77.5	....	....	....	....	96.1	87.6*	72.8	56.7	118.0	111.5*	105.7	96.7
Textiles	119.0	117.7*	96.4	54.0	88.7	90.8	69.0	39.5	155.5	144.3*	132.2	64.5	113.3	119.5	118.4	78.3

*Revision.

Timing Oil Breakers

By G. F. SARGENT and C. H. M. WHITE

Newton Center, Mass.

During times of money stringency the operating engineer finds it necessary to recondition station equipment with as little expense as possible. The scheme* described in this article illustrates a simple method of timing oil circuit breakers so that curves may be plotted of contact travel in inches against time in cycles. Any deviation from the characteristic curve of a normal breaker will enable the engineer to locate the trouble in the mechanism.

The modern oil circuit breaker will function with consistent accuracy when properly maintained. It is found that the normal opening and closing operations may be repeated with a variation of about $\frac{1}{16}$ in. in an 11-in. travel, an error which is negligible. The device shown in Fig. 1a is designed particularly for breakers where the cross-head is solidly connected to the operating rod. It consists of a wooden scale support which carries a thin bronze runner. This runner may be clamped in any position in the support. The height of the bottom edge of the runner is indicated on an inch scale marked in the front of the support.

Screw clamps and a variable strut permit quick attachment of the device to the top of the breaker cell within 2 in. of the operating rod of the oil circuit breaker. To the operating rod a roller clamp is attached (Fig. 1b). The brass roller is sprung to roll on the front of the scale support so that, when the breaker is opened, the brass roller moves up the front of the scale support a distance equal to the travel of the breaker contacts. During the course of its travel the brass roller rides over the edge of the bronze runner, which is ground to a feather edge in order to eliminate bouncing of this contact. The assembly of these parts constitutes a special switch which is used to stop the cycle counter at any point in the breaker travel.

**See Relay Handbook Ed. 1926, pages 491-496, for methods of timing.*

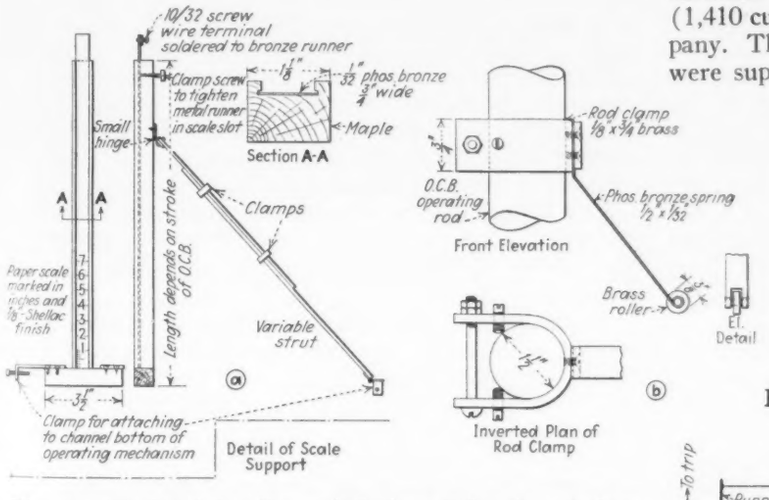


Fig. 1—(a) Special roller switch for oil breaker timing; (b) details of roller timing clamp

The scale support is set up firmly in position so that it is parallel to the operating rod of the breaker. The roller clamp is attached to the rod at a convenient point. The end of the bronze runner is gradually lowered until it just makes contact with the roller wheel. This point of start can be determined electrically by running the cycle counter alone and then stopping it by lowering the runner to the wheel. When the connections are made in accordance with Fig. 2 the two-pole switch may be closed. The breaker trips simultaneously with the starting of the cycle counter. The roller wheel, traveling with the breaker mechanism, stops the cycle counter positively at any predetermined setting by short circuiting the escapement coil. The bronze runner may be raised to different scale points and the time recorded for each operation. This wiring may be used on breakers with grounded metal operating rods as the roller clamp is connected to the ground side of the 110-volt a.c. circuit.

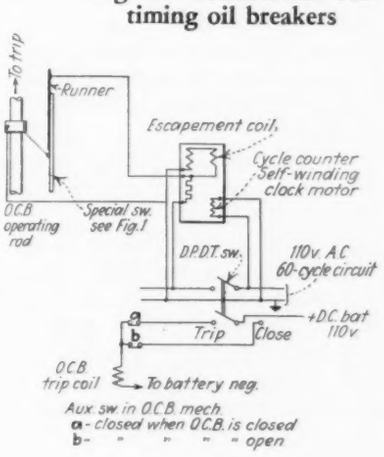


Fig. 2—Connections for timing oil breakers

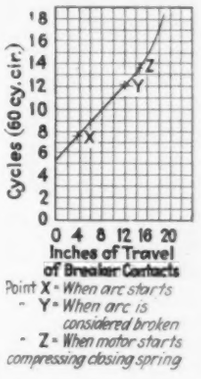

Cycles (60 cy. cir.)
0 2 4 6 8 10 12 14 16 18
0 4 8 12 16 20
Inches of Travel of Breaker Contacts
X
Y
Z
Point X - When arc starts
Y - When arc is considered broken
Z - When motor starts compressing closing spring

Fig. 3—Typical composite timing curve for oil breakers

Typical curve shown as a composite curve of about 100 breakers, tested in this manner. It is interesting to note that about five cycles elapse before the breaker contacts start to move at all.

Down-Stream Tunnel Adds Head

A recently completed hydro-electric plant in Switzerland, described in the Schweizerische Wasser- und Energiewirtschaft, embodies an ingenious method of utilizing some of the drop below the plant, thereby adding more than 25 per cent to the available head.

A dam raises the elevation of the Limmat River, near the village of Wettingen, about 18 m. (59 ft.) above the original level, creating a narrow lake 9.8 km. (6 miles) long. Below the dam site the stream descends sharply in a long loop.

While the spillway discharges into the old channel, the turbines discharge into a depressed pool off to one side. This pool is connected with the stream, below the loop, by a submerged tunnel about 1,900 ft. long. The effective mean head was by this means increased to 22.8 m. (75 ft.).

The installation consists of three vertical-shaft Kaplan turbines each with a capacity of 10,000 hp. at 40m³ (1,410 cu. ft.) per second, built by Escher Wyss & Company. The three-phase generators, at 10,000 kva. each, were supplied by Brown, Boveri & Company. The annual output is expected to be about 135,000,000 kw.-hr., 60 per cent in the summer half-year and 40 per cent in winter. The new plant constitutes an addition to the energy supply of Zurich, the largest city in Switzerland.

Manufacturing Code Approved

Statistical controls, price controls. Supervisors for each class of products. An interpretation of the code.

ON AUGUST 4 President Franklin D. Roosevelt adopted and approved a code for the electrical manufacturing industry. This code was submitted by a committee of N.E.M.A. and was modified and changed in conformity with suggestions made in the hearings at Washington. Several outstanding aspects of the code have created a great deal of discussion and it has been used as a sample for similar complicated industries. The chief features of the code are: (1) Complete provision for the manufacturers to carry out the code without NRA dictators or even consultants; (2) the use of published price lists and discount sheets to eliminate cut price bidding and to stabilize trade; (3) the autonomous jurisdiction given each product group to carry out the code. Comment on the several articles of the code may be made in more detail:

ARTICLE I—Under the definition there must be individual rulings on the term "natural affiliates." This is a permissive and not a coercive clause, whereby any group of manufacturers making a product that sells to the electrical industry or that has the same general problems and trade set-up may operate under the code if they so desire and if their application is approved by the board of governors.

A second part of this article is the exception clause, whereby the administrator may exempt a subdivision of the manufacturers who wish to operate under their own code. From the point of view of Washington it would be best to centralize administration in N.E.M.A. for the entire industry. Also, some provisions in the code give advantages that may not be obtained in separate codes, notably the provision to modify contracts to conform to changed costs. It is also evident that the blanket code will apply until each of the divisional codes is produced and approved and this time delay is very vital at present. Thus, with the autonomous administration provided for each product group under this code it seems advantageous for all manufacturers to operate under this approved code.

ARTICLE III—The labor provisions are clear and paragraph (b) provides the data for adjustments, if any are necessary, above the minimum wage scale. This flexibility was considered essential because of the variable conditions encountered and, in the final analysis, interference or ordered changes may be said to rest upon the good faith with which manufacturers handle the skilled labor rates.

ARTICLE IV—Here again flexibility, instead of a rigid formula, is depended upon to meet seasonal or peak labor demands.

ARTICLE V—This fixes the N.E.M.A. board of governors as executive administrator of the code. It will be noted that no government man sits on the board. Thus full confidence and full authority are given the manufacturers to conduct their business. Full power is given to obtain statistics, annual balance sheet statements, appoint supervisors and do other things necessary to carry out the code.

It is to be expected that supervisory agencies will be appointed at once for ten to twenty product classification groups; for example, wire and cable. These supervisors, one to a group, have full power to administer the code for their groups and it is expected that each supervisor will be an executive in the product group so that his knowledge and his decisions affect his business as well as that of his associates. If full support and co-operation is given each of these supervisors and they are competent, it is believed that detailed procedure can be developed without friction and without involving either red tape or the intervention of the federal administrator. The whole code is based upon carrying out the intent in an unselfish and co-operative manner in the public interest.

ARTICLE VIII—This provides for a uniform accounting system—for distribution as well as production. Such a complete system is not available now. Nor should a factual and accurate system be required because the code is based upon relative conditions and the simplest possible accounting formula should be used. Undoubtedly many items would be difficult to get, or to agree upon, if a detailed cost accounting was had. For example, no one knows the cost of distribution today. Also, judgment enters into the problem; for example, shall overhead be the current expense or, say, the ten-year average overhead based upon the past business and budgets for future business?

One good suggestion is that a definite percentage for research and development and another for advertising and promotion be included in any acceptable costing formula.

ARTICLE IX—This article defines trade practice and selling practice. Apparently the costs must be those to the ultimate customer, and this, when fully determined, inevitably will tend to establish trade channels for all products and even indicates a basis of resale price control. Flexibility is warranted and used in the exception clause covering sales of dropped lines, etc. The other exception clause for selling below cost to meet competition permits sales to be made despite a high development cost, for example, until the volume of sales permits profits. It permits of pioneering to get volume and involves a time investment.

It is stated, however, that an entire group must agree to these exception clauses as well as the supervisor, and thus great care will be exercised in using these clauses, for the exceptions will apply to all in the group.

ARTICLE X—This article affords a very interesting control of trade practices. Price lists and discount sheets are used and goods must be sold at these published values. Prices and discounts may differ in value,

but while in effect they fix all bids. Changes, therefore, in price lists and discount sheets require time, and whether made up or down affect the entire sales volume and margin and not a single order. There is every reason to believe, therefore, that only justifiable changes will be made.

Conclusion

The success or failure of the code in stabilizing the manufacturing business depends upon the competency of the supervisors and the type of co-operation each receives from the manufacturers in his group. This code is to go into operation at once and many decisions must be based upon judgment instead of facts; this necessitates wholehearted co-operation with the group supervisors. The government gains its objectives in the labor clauses, but the industry will gain its objectives of trade stabilization only if all manufacturers give a fair and open-minded trial of the statistical and trade practice features of the code. There is a big task ahead to make it effective and action must replace debate in fixing business procedure under the code.

National Industrial Recovery Code for the Electrical Manufacturing Industry

To effectuate the policy of Title I of the National Industrial Recovery Act, the following provisions are established as a National Industrial Recovery Code for the Electrical Manufacturing Industry:

I. **Definitions**—The term "electrical manufacturing industry" as used herein is defined to mean the manufacture for sale of electrical apparatus, appliances, material or supplies, and such other electrical or allied products as are natural affiliates. The term "person" as used herein shall include natural persons, partnerships, associations, trusts, trustees, trustees in bankruptcy, receivers and corporations. The term "employer" as used herein shall include every person promoting, or actively engaged in, the manufacutre for sale of the products of the electrical manufacturing industry as herein defined, *provided, however,* that organizations or groups of employers representing a substantial part of any branch or subdivision of the industry may be exempted by the administrator from the provisions of this code. The term "effective date" as used herein is defined to be the eleventh day after this code shall have been approved by the President of the United States.

II. As required by Section 7 *(a)* of Title I of the National Industrial Recovery Act, the following provisions are conditions of this code:

"(1) That employees shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint, or coercion of employers of labor, or their agents, in the designation of such representatives or in self-organization or in other concerted activities for the purpose of collective bargaining or other mutual aid or protection; (2) that no employee and no one seeking employment shall be required as a condition of employment to join any company union or to refrain from joining, organizing, or assisting a labor organization of his own choosing, and (3) that employers shall comply with maximum hours of labor, minimum rates of pay, and other conditions of employment, approved or prescribed by the President."

III. *(a)* On and after the effective date employers shall not employ any one under the age of sixteen years.

(b) On and after the effective date the minimum wage that shall be paid by any employer to any employee engaged in the processing of the products of the electrical manufacturing industry and in labor operations directly incident thereto shall be 40 cents per hour, unless the rate per hour for the same class of labor was on July 15, 1929, less than 40 cents, in which case the rate per hour paid shall be not less than the rate per hour paid on July 15, 1929, but in no event shall the rate per hour be less than 32 cents per hour, and provided, also, that learners may be paid not less than 80 per cent of the minimum rate paid determined in the manner above provided, but the number of learners receiving less than such minimum rate so determined shall not exceed 5 per cent of the total number of employees engaged in the processing of products and in labor operations directly incident thereto.

(c) On and after the effective date the minimum wage that shall be paid by any employer to all other employees, except commission salespeople, shall be at the rate of $15 per week; provided, however, that office boys or girls, and learners may be paid not less than 80 per cent of such minimum wage, but the number of such office boys or girls, and learners paid at a rate of less than $15 per week shall not exceed 5 per cent of the total number of employees covered by the provisions of this paragraph *(c)*.

(d) The minimum rate of wages provided in this article shall apply to all employees in all localities unless the administrator or his representative shall fix a lower rate for particular localities.

(e) Not later than ninety days after the effective date the electrical manufacturing industry shall report to the administrator through the board of governors of National Electrical Manufacturers Association the action taken by all employers in adjusting the hourly wage rates for all employees receiving more than the minimum rates provided in paragraph *(b)* of this article.

IV. On and after the effective date employers shall not operate on a schedule of hours:

(a) For employees engaged in the processing of products of the electrical manufacturing industry, and in labor operations directly incident thereto, in excess of 36 hours per week.

(b) For all other employees, except executive, administrative and supervisory employees, and traveling and commission salespeople, in excess of 40 hours per week.

Provided, however, that these limitations shall not apply to those branches of the electrical manufacturing industry in which seasonal or peak demand places an unusual and temporary burden upon such branches; in such cases such number of hours may be worked as are required by the necessities of the situation, but at the end of each calendar month every employer shall report to the Administrator through the board of governors of National Electrical Manufacturers Association, in such detail as may be required, the number of man-hours worked in that month on account of seasonal or peak demand requirements, and the ratio which said man-hours bear to the total number of man-hours of labor during said month; and

Provided, further, that these limitations shall not apply in cases of emergency, but at the end of each calendar month every employer shall report to the supervisory agency, hereinafter provided for, in such detail as may be required, the number of man-hours worked in that month for emergency reasons and the ratio said emergency man-hours bear to the total number of man-hours of labor during said month.

V. National Electrical Manufacturers Association is hereby designated the agency for administering, supervising and promoting the performance of the provisions of this code by the members of the electrical manufacturing industry.

With a view to keeping the President of the United States and the administrator informed as to the observance or non-observance of this code and as to whether the electrical manufacturing industry is taking appropriate steps to effectuate in all respects the declared policy of the National Industrial Recovery Act, each employer shall, not less than once in each year, prepare and file with the board of governors or the executive committee of National Electrical Manufacturers Association an earnings statement and balance sheet in a form approved by said board of governors or said executive committee or in a form acceptable to any recognized stock exchange. Each employer shall likewise prepare and file with such person or organization as the board of governors or the executive committee of National Electrical Manufacturers Association may designate and at such times and in such manner as may be prescribed, statistics of plant capacity, volume of production, volume of sales in units and dollars, orders received, unfilled orders, stocks on hand, inventory, both raw and finished, number of employees, wage rates, employee earnings, hours of work, and such other data or information as the board of governors or the executive committee of National Electrical Manufacturers Association may from time to time require.

VI. Except as otherwise provided in the

National Industrial Recovery Act all statistics, data and information filed in accordance with the provisions of Article V shall be confidential, and the statistics, data and information of one employer shall not be revealed to any other employer except that for the purpose of facilitating the administration and enforcement of the provisions of this code, the board of governors or the executive committee of National Electrical Manufacturers Association, by their duly authorized representatives (who shall not be in the employ of any employer affected by this code), shall have access to any and all statistics, data and information that may be furnished in accordance with the provisions of this code.

VII. Any employer may participate in any endeavors of National Electrical Manufacturers Association in the preparation of any revisions of, or additions or supplements to, this code by accepting the proper pro rata share of the cost and responsibility of creating and administering it, either by becoming a member of National Electrical Manufacturers Association or by paying to it an amount equal to the dues from time to time provided to be paid by a member in like situation of National Electrical Manufacturers Association.

VIII. Every employer shall use an accounting system which conforms to the principles of and is at least as detailed and complete as the uniform and standard method of accounting set forth in the sixth edition of the Manual of Accounting, prepared and published by National Electrical Manufacturers Association, and a costing system which conforms to the principles of and is at least as detailed and complete as the standard and uniform method of costing to be formulated or approved by the board of governors or executive committee of National Electrical Manufacturers Association, with such variations therefrom as may be required by the individual conditions affecting any employers or group of employers and as may be approved by the board of governors or the executive committee of National Electrical Manufacturers Association or the supervisory agency and made supplements to the said Manual of Accounting or method of costing.

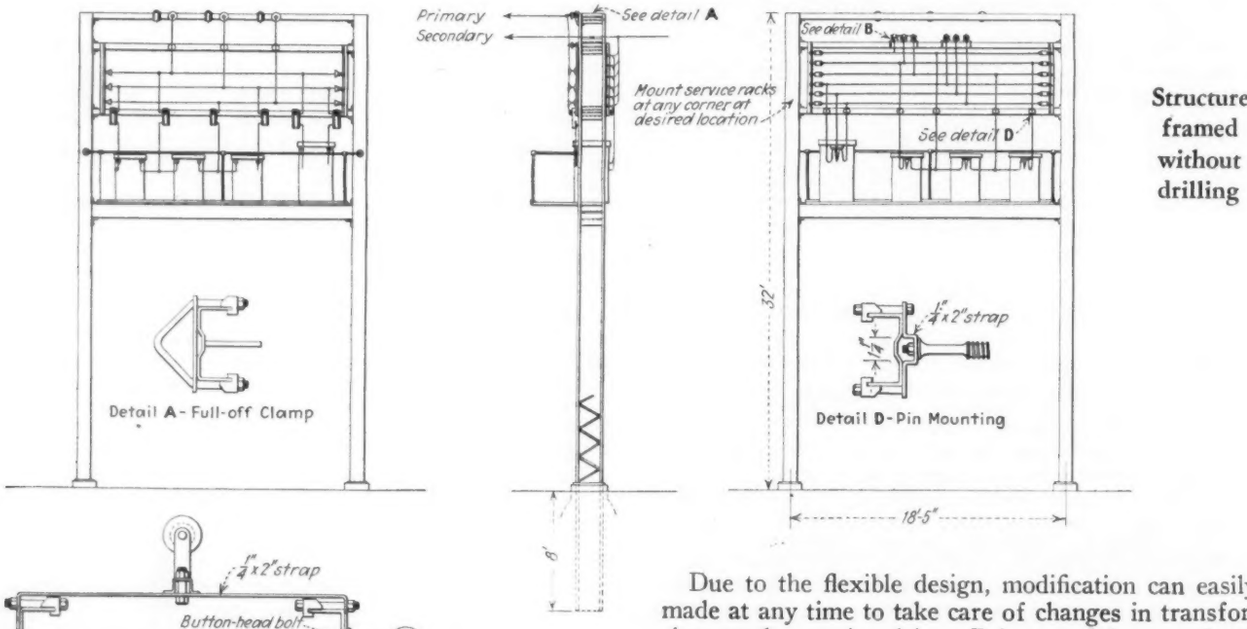
IX. No employer shall sell or exchange any product of his manufacture at a price or upon such terms or conditions that will result in the customer paying for the goods received less than the cost to the seller, determined in accordance with the uniform and standard method of costing hereinabove prescribed, provided, however, that dropped lines, seconds, or inventories which must be converted into cash to meet emergency needs may be disposed of in such manner and on such terms and conditions as the supervisory agency may approve and as are necessary to move such product into buyers' hands, and provided further that selling below cost in order to meet existing competition on products of equivalent design, character, quality or specification shall not be deemed a violation of this article if provision therefor is made in supplemental codes for any branch or subdivision of the industry, which may be hereafter prepared and duly approved by the administrator.

Clamp Connections Give Flexibility to Transformer Structure

By L. M. GROW

Central Ohio Light & Power Company, Wooster.

Through the use of clamp type connections in the design of an overhead transformer structure for erection across alleys a flexibility in arrangement is provided that could not be obtained with the conventional method of using bolts and punched or drilled holes in the steel members. All main members are Weltrus fabricated sections assembled with standard angles and standard bolted connections. Insulator pins, line pull-off clamps, lightning arresters and distribution racks are mounted at any desired location on any of the main members through the use of suitable mounting straps bolted to the flange with flange clips. Primary cutouts have "U" bolt type of mountings and may be clamped at any location. Services can be taken off either side of the columns at the level of the buses by clamping distribution racks to the column faces. The space between the bus strain angles and the columns permits sufficient clearance for jumpers from the secondary bus to the service rack when services are taken off the primary side of the structure. The platform is of creosoted oak planking and extends on one side of the structure only, so as to permit raising of transformers on the clear side. A guard rail of 1¼-in. pipe provides safety to the linemen, particularly while replacing blown fuses.


Primary
Secondary
See detail A
Mount service racks at any corner at desired location
See detail B
See detail D
32'
18'-5"
6'
Detail A - Full-off Clamp
Detail D - Pin Mounting
Detail B - Mounting Strap for Racks or Pins
Button-head bolt
Racks may be mounted on top or at either end. Use two straps per rack. If primary runs straight through, use above strap with steel pin on top

Structure framed without drilling

Due to the flexible design, modification can easily be made at any time to take care of changes in transformer sizes or changes in wiring. Primary wiring may be three or four wire and secondary wiring may be separate three phase and single phase or four wire, as required by the particular system employed.

Service Cable Development Under New Code

By O. K. COLEMAN
American Gas & Electric Company

SERVICE equipment for domestic installations has received a great deal of attention in the last five years. Considerable time and money have been spent in development. While progress has been made, it has been slow to date. Service equipment such as switches, breakers, fittings, etc., have received probably more than their due amount of attention and are at the present time in a higher state of development than the service conductor assemblies. Although the service conductors are the most important part of the installation and the fundamental requirements of a conductor assembly are comparatively simple, development has met many obstacles, principally due to conventions and precedent.

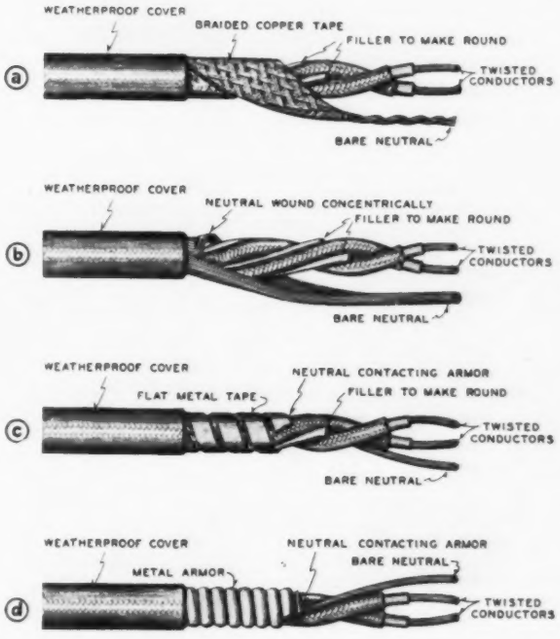
Practically all of the early service entrances were made by the installation of individual wires within the wall by the "knob-and-tube" method. This practice is entirely sound from a safety standpoint, it is still approved and there are several million houses supplied in this manner. Because of the inconvenience of installing large capacity services of this type and also because the wiring is subject to tampering its use has been generally discontinued.

Conduit type service followed the "knob and tube" because that was the only convenient and practical method available at the time, and, once established, it held its position for a long period. Cable type services were first recognized in the 1931 National Electrical Code, but because only conduit had been used on the exterior of the building up until that time the general impression seemed to be that a cable had to be of "battleship" construction or practically equivalent to conduit.

There are a number of obvious advantages to cable. If of the proper construction it is easier to install than either "knob and tube" or conduit. Since it is made up in a complete assembly, the conductors protected by outer covering, there is less chance of the insulation being damaged in installation. It is also, of course, considerably more flexible than conduit and can be run complete from terminal to terminal without joints or the use of fittings.

After the code recognition of cable for service entrances in 1931 a number of simplified cables were developed, but these were approved for use only in some localities. The 1931 code contained also another advancement in the art, in the recognition of bare neutral for use in service entrances, but this was limited to rigid conduit, and consequently cable, making use of the bare neutral, was not generally accepted by the inspectors in the field. There was one type of bare neutral cable used in some sections, but this was not waterproof and had to be installed concealed between the walls (see Fig. 5). While the code does not prohibit this practice, it carries a fine print recommendation discouraging it (probably due to precedent established by conduit which cannot generally be installed except on the outside of the wall). In addition, there are some construction objections to the concealed service, particularly in connection with the outdoor meter, which is growing in popularity, as well as possible increased susceptibility to tampering.

There has been another revision of the National Electrical Code this year and a new issue will follow shortly. The new code will recognize the use of bare neutral in service cables. This will offer unlimited possibilities in the development of a satisfactory service cable, assuming that the handicap of precedent is at last broken.



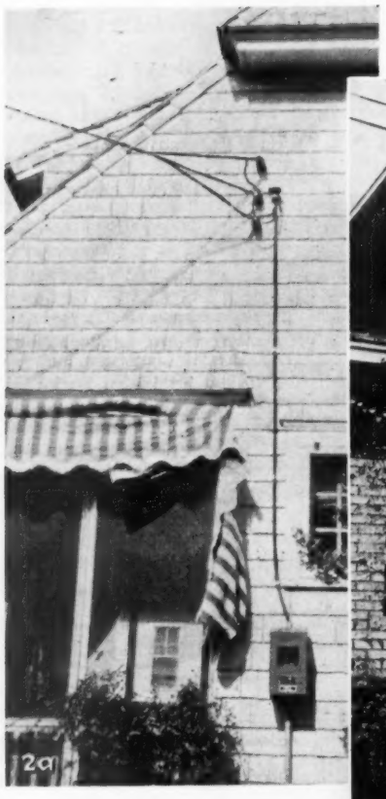
Figs. 1a, b, c, d—Four developments in service cable

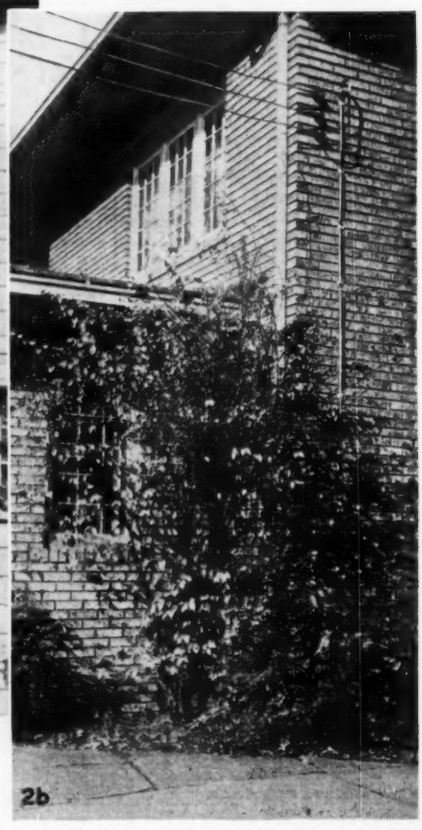
Service cable can be divided into two general classes: Drop cable, that part of the cable extending from the pole to the attachment on the house, and service entrance cable, that part of the cable from the attachment on the house to the service entrance equipment. There is, of course, no reason whatsoever why one cable cannot be developed that can be used for both purposes; that is, to extend from the pole in the street up to the service entrance equipment. This, then, will probably create a demand for three types of cable, one that is satisfactory for extending from pole to entrance equipment, one for pole to house only and one for use on house only (see Figs. 2a, b and 4).

A satisfactory service cable in order to be useful and safe should be:

1. Adequately insulated.
2. Flexible, small and light.
3. Covered with a weatherproof outer covering.
4. Of a pleasing color and repaintable.
5. Acceptable to inspection agencies.

Flexibility is not only a requirement for convenience but also a safety asset, since it will permit the cable and outdoor equipment to be installed so as to be protected from mechanical injury and should therefore obviate the necessity for ironclad battleship construction (see Figs. 3a and b).



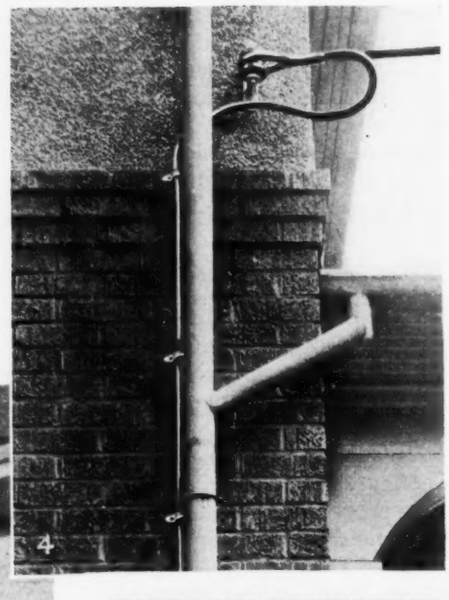


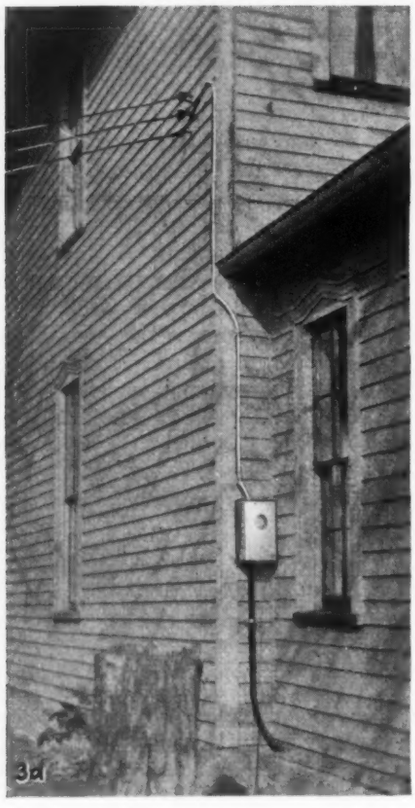
Figs. 2a and b — Typical cable and meter inclosure installations. (a) Employs twisted cable from pole to house. Meter is normally concealed by shrubbery held back for this photo. (b) Open-wire drop from pole to house. Meter concealed by shrubbery.

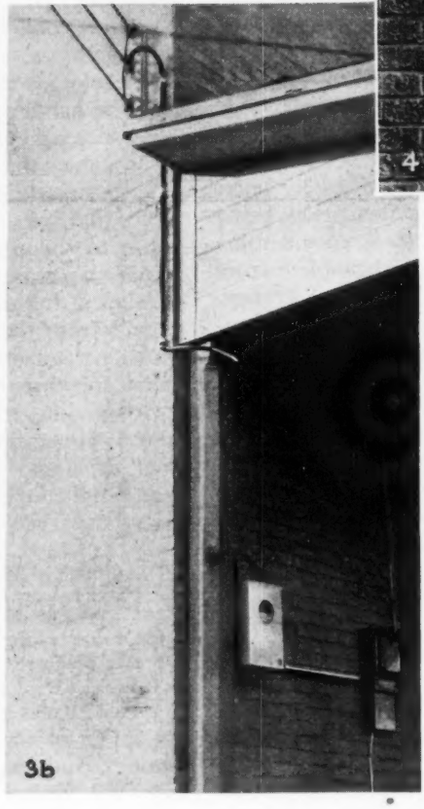
Figs. 3a and b—Need of flexibility in service cable shown by these two outdoor meter installations.

Fig. 4—Continuous cable from pole to meter inclosure. Note cable is installed on house so it is invisible from street.

Fig. 5—Concealed service using bare-neutral armored cable. A safe, neat and economical method, but having some construction objections.







In the two years of code-sanctioned service cable only that provided with an interlocked steel type armor has been generally accepted as an approved material. The code does not, however, contain any details of construction, and by the recognition of the bare neutral there is no reason whatsoever why a satisfactory cable cannot be provided in which the necessary mechanical protection, when needed, is provided by the proper use of the bare neutral. This might be accomplished in a number of ways, for instance:

(a) A copper braided tape made up of small copper wires might be wrapped around the cable before the outer weatherproof covering is applied (Fig. 1a).

(b) Small wires of copper or other suitable material might be wound concentrically around the insulated conductors (Fig. 1b).

(c) A bare neutral conductor of the conventional stranding might be twisted together, with the insulated conductors, and a light flat metal tape wound around the three and in contact with the neutral (Fig. 1c).

(d) A construction similar to that above except using an interlock steel tape (Fig. 1d).

Although metal has been the most common material used for mechanical protection, there is a considerable amount of favorable experience with non-metallic materials. Not forgetting "knob and tube," which is generally conceded among electrical men as being one of the safest forms of house wiring, there is in addition the long and satisfactory record of non-metallic sheath cable. This, then, suggests the possibility of a non-metallic service cable. There is already some experience with this type of cable installed in residences, and in addition there is a great deal more experience with non-metallic cables for service drops and open line wiring. For some purposes non-metallic cable is considerably more practical than metallic cable. As an example there can be mentioned tree cable, which is protected by a very tough fibrous braid and which is put to more severe mechanical abuse than probably any other cable.

In view of recent code changes, the use of steel or similar armor as heretofore employed for mechanical protection without the electrical reinforcement of the bare neutral should no longer be necessary and may be highly undesirable in connection with service cable. A light metallic sheath, unaided by a parallel conductor, does not have sufficient electrical carrying capacity to clear safely the electrical circuit in case of a ground and a fire may result. A bare neutral, however, in contact with the sheath of such a cable, will supply the necessary carrying capacity and eliminate this hazard. It will, therefore, be seen that code recognition of bare neutral in service cable not only permits broader development of simplified cables but makes it possible to improve them greatly.

This would appear to offer the manufacturers an excellent opportunity to break away from tradition and develop a new group of service cables suitable for various classes of service, in accordance with the new and broadened provisions of the code. It is obvious that those taking first advantage of the new code provisions will have the prior experience to be applied in the development of new types of interior wiring cables embodying perhaps the bare neutral. The encouragement and sanction given to the use of bare neutral by the new code would definitely indicate that approval of such materials may be looked forward to when and if the proper development has been made, and the adequacy and safety of the newer materials demonstrated.

Chinese Plants Generate 2.5 Billion Kw.-Hr. Annually

Electric power plants in China have an aggregate rating of 893,645 kw., of which 37.5 per cent is in industrial plants, according to statistics for 1932 compiled, for presentation at the World Power Conference sectional meeting in Stockholm, from official reports to the Chinese National Construction Commission. The output of these plants in 1931 was 2,475,000,000 kw.-hr., of which the industrial plants contributed 41 per cent. Compared with 1929 the number decreased by 59, but the aggregate rating increased by 58,279 kw.

Alternating current at 50 cycles predominates, such equipment constituting 65.2 per cent; 27.2 per cent is at 60 cycles. The latter, it is stated, will ultimately be forced to change to 50 cycles. Only 6.0 per cent, exclusively in industrial plants, is at 25 cycles and 1.6 per cent is direct current.

Investment in transmission and distribution equipment is a much smaller fraction of the total than in most European and American systems. It averages about 30 per cent, against 55 per cent for generating equipment and 15 per cent for other tangible property. This is because the stations serve only local territory and their distribution network is not so extensive, reliable and elaborate as it should be.

Investigation of more than 200 utilities showed, among other items: (1) First block rate per kw.-hr. for lighting, $0.17 to $0.40. [The prices are apparently in "Chinese dollars"]; (2) first block rate per kilowatt-hour for retail power, $0.05 to $0.20; (3) most widely used generating and primary distribution voltage, 2,300 volts; (4) standard distribution, 220/380 volts, three-phase, four-wire; (5) highest transmission voltage south of Great Wall, 33,000 volts; (6) highest generator voltage, 13,200 volts; (7) highest steam pressure, 600 lb.; (8) best average coal-burning efficiency, 0.76 kg. (1.67 lb.) per kilowatt-hour.

Other data abstracted from the report are given in the accompanying tables.

Number, Rating and Output of Plants in 1931

Kind of Plant	No.	Kw.	Kw.-Hr. (Millions)
Utility	519	558,270	1,467
Industrial	146	335,375	1,008
Totals	665	893,645	2,475

Classification by Prime Movers

	Kw.	Per Cent
Steam turbine	729,674	85.00
Steam engine	84,325	9.83
Oil engine	35,439	4.13
Gas engine	6,718	0.78
Water turbine	2,229	0.26
Totals	858,385	100.00

Utility Plant Ownership and Investment

	No. of Plants	Investment (Chinese $)	Generating Capacity Kw.
Private	471	79,475,040	195,449
Public	27	27,665,500	77,775
Foreign	21	197,150,000	285,046
Totals	519	304,290,540	558,270

Distribution Costs of Electric Service

By CONSTANTINE BARY

Engineer Rate and Standard Practice Department, Philadelphia Electric Company

IN THE issue of March 18, 1933, ELECTRICAL WORLD published an article entitled "Distribution Costs Subjected to New Analysis." This article was largely devoted to a paper presented by Clayton W. Pike before the Institute of Public Engineering held in New York January 20, 1933, and published in the second annual report of the Power Authority of the State of New York.* An analysis of the data presented in this article discloses a number of apparent inaccurate assumptions as well as incorrect application of mathematical principles, all of which, naturally, lead to erroneous conclusions.

A critical review of the methods used in the article in arriving at $13 as being the annual cost of distribution, or 2.36 cents per kilowatt-hour, for an average residence customer discloses that, by using the same basic data as appear in the original article, the corrected annual cost of distribution for an average residence customer requiring 550 conductor-feet of overhead distribution line facilities should be $22.30 per customer, equivalent to 4.05 cents per kilowatt-hour for an average residence consumption of 550 kw.-hr. per customer.

The object of the present paper is to present: (1) an analysis and correction of the costs presented in the Pike paper and (2) a discussion of the omission of essential factors from the determination of the costs presented in the article and of the apparently erroneous methods used.

Average costs may well serve as an illustration for theoretical considerations of the principles and factors involved in determining the items of distribution costs. *They cannot be used, however, as a standard of measurement of distribution costs for individual specific properties in actual practical operation.* Local geographic and economic conditions, standards of construction and standards in the degree of service rendered affect the costs of distribution of any specific system.† Their presence is not disclosed in average figures. But their practical existence offers possibilities of rather wide deviations of costs for any specific property from the average costs of a theoretical study. *These conditions cannot be ignored; they must be given proper consideration in any practical application.*

Equation for distribution investment

The equation presented in the article for investment in distribution facilities per customer is:

$I = \$65 + \$0.05$ (kw.-hr. $- 550$) $+ \$0.08$ (feet of conductor $- 500$) $+ \$0.65$ (feet of underground conductors)

where the constant factor of $65 is obtained as follows:

Poles and wires	$32
Line transformers	10
Meters and services	19
Allocated share of general investment	4
Total	$65

Let us apply the foregoing formula to an assumed community of customers using, on an average, 550 kw.-hr. per year per customer and requiring 70 ft. of overhead conductor wire per customer. The average investment per customer allowed for distribution facilities from the above equation will be:

$$I = \$65 + \$0.05\ (550 - 550) + \$0.08\ (70 - 500)$$
$$= \$65 - \$34.40 = \$30.60$$

This allowance, however, is insufficient to cover the investment for:

Line transformers of	$10.00 per customer
Meters and services of	19.00 per customer
Proportionate share of general investment $= 4 \times \frac{29}{61}$	1.90 per customer
	$30.90 per customer

Thus we have a deficit of $0.30 in the allowance for transformers, meters and services and general investment, and no provision for the investment in poles and wires, notwithstanding the fact that 70 ft. of wire per customer is required.

The limitations of the equation may perhaps be most clearly demonstrated, from a purely theoretical consideration, by assuming that the kilowatt-hour consumption per customer is zero and that the conductor-feet per customer are zero. Substituting these factors in the above equation, we obtain:

$$I = \$65 + \$0.05\ (-550) + \$0.08\ (-500)$$

which results in a negative amount of $2.50, which, of course, is an impossibility and an absurdity.

The above analysis of the equation makes it evident that an error exists in it which will necessarily produce misleading results for certain conditions differing from those considered to be average.

Cost of distributing electric service to an average residence consumer

Comparison will be made of the average cost factors stated in the Pike paper with corrected figures (Table A), which are believed to be more reasonable and which are derived from the same basic data as used by Mr. Pike.

Supply of electric service will be assumed as that to an average residential consumer with an annual consumption of 550 kw.-hr., located in a territory requiring 550 conductor-feet of aerial distribution facilities per customer.

General comments on omissions and the fallacy of averages

1. *Commercial Expense*—The commercial expense item may be chosen as a good example of erroneous treatment of weighted average unit costs. The article shows $1.80 as the commercial expense for an average residential customer, notwithstanding the fact that the statistics presented for a number of companies indicates an average of $3.22 per customer.

**The Pike paper, along with the others presented at the meeting, has just been published by New Republic, Inc., New York, under the title "What Electricity Costs" and under the editorial direction of Morris L. Cooke.*

†Chairman Maltbie of the New York Public Service Commission emphasized this point in referring to the Pike paper—Ed.

Table A—Major Pike's Unit Cost 42 per Cent Low

	Figures From Pike Article	Corrected Figures
Section I—Investment per Average Residential Customer		
Poles and wires	$30.00	$61.60
Line transformers	6.50	8.56
Services, meters and meter installations	15.00	24.75
Total direct fixed capital	$51.50	$94.91
Utilization and general	3.50	6.47
Total direct and general fixed capital	$55.00	$101.38
Working capital	.....	2.52
Grand total investment in fixed and working capital	$55.00	$103.90
Section II—Annual Fixed Charges on Investment per Average Residential Customer		
Applicable to fixed and working capital at 7.62 per cent	.....	$7.92
Applicable to fixed capital only, at 4.25 per cent	.....	4.31
Total fixed charges, at 11.5 per cent	$6.35	$12.23
Section III—Annual Operating Expense per Average Residential Customer		
Distribution system	$2.00	$2.96
Utilization system	0.50	0.70
Commercial department	1.80	3.00
New-business department	1.25	1.80
Total direct operating expense	$5.55	$8.46
General	1.05	1.61
Total direct and general operating expense	$6.60	$10.07
Section IV—Summary of Annual Cost of Distributing Electricity to an Average Residential Customer		
Fixed charges on fixed and working capital	$6.35	$12.23
Operating expenses	6.60	10.07
Total annual cost per customer	$12.95	$22.30
Annual cost per kw.-hr. for an average residential customer of 550 kw.-hr. per year, cents	2.36	4.05

A little consideration will show that it is incorrect to fix the figure of $1.80 for the residence customers when the average unit cost for all customers is $3.22, since this is contrary to either mathematical principles or any reasonable interpretation of basic considerations.

Costs for billing, meter reading, etc., are higher for certain classes of customers, usually of a wholesale nature, than for the residential class because of the more elaborate rate schedules required for the former type of customer. The number of such customers, however, is small as compared with the large number of customers not requiring any special billing procedures. The figure of $3.22 per customer is the weighted average cost for all customers and, therefore, the unit cost of the residential class, which, in number of consumers, far outweighs any other class, will approach this figure of $3.22.

Thus, assume the number of consumers requiring uniform billing methods as 98 per cent of the total of consumers and the unit cost of billing remaining 2 per cent of customers to be five times greater than the unit cost of billing the group which comprises the 98 per cent of the total number of customers. With the over-all average set at $3.22 the unit cost for the uniform billing customers is $2.98 instead of $1.80.

To be $1.80, the cost of billing the special customers would have to be more than 4,000 per cent higher than that of customers requiring ordinary billing methods to keep the weighted average unit cost per customer at $3.22. This, of course, is unreasonable.

The figure of $1.80 per customer used in the article for the commercial expense of residential customers is low and is contrary to facts.

2. *Investment in Distribution Lines, Meters, Services and Transformers*—The figures derived for the investment in distribution lines, meters and services, and even transformers, for residential consumers, are similarly low and contrary to figures presented by the tables included with the article. The derivation of these figures neglects giving the proper weight to the large number of small customers, services and meters, which automatically exert a predominant effect upon the weighted average figures.

3. *Operating Expense of Distribution Lines. Utilization and New Business*—Distribution operating expense for residential customers is necessarily low too, since its calculation is based upon a percentage of investment in distribution facilities which in itself is low, and because the derivation neglects taking into consideration the effect produced by the large number of residential customers upon the weighted average cost figures derived in the tables. The latter reason applies similarly to the utilization and new-business expenses for residential customers, which are also low.

4. *Construction Overheads*—It is impossible to ascertain definitely whether construction overheads are included in any of the Pike figures representing physical costs of facilities. Inclusion of construction overheads will increase by an appreciable amount the investment figures shown.

5. *Working Capital*—No mention is made in the paper of any allowance for working capital. Working capital is an essential part of the cost of rendering service and must be included in any equitable cost finding study.

Several detail figures underestimated

I. Investment

1. *Poles and Wires*—(a) Average Conductor-Feet per Customer—Table II‡ of the article develops 563 ft. as the grand average conductor-feet per customer. An Appendix XIII of the original paper this figure is reduced to 500 ft. for an average residential customer on the grounds that few cities of any considerable size are included in the tabulation, and, therefore, the apparent customer density is lower than would be found for "normal" conditions. This may be true, but the reduced number of feet per customer is used in conjunction with aerial costs only, not taking into consideration the greater unit cost per foot of underground facilities which would be present in the larger cities. This, of course, is inconsistent with this reasoning and incorrect as to the application of mathematical principles of averages.

The true average figure for conductor-feet per average residential customer, when costs of aerial facilities are used from the figures presented in Table II,‡ should be taken as 563, which may be rounded off to 550 ft. per customer.

(b) *Unit Costs per Conductor-Foot*—In Table III there was derived an average cost of poles and wires per conductor-foot of 10.6 cents and a cost of wires per conductor-foot of 4.91 cents, thus leaving 5.69 cents to cover the cost of poles per conductor-foot of wire.

In Appendix XIII a figure is obtained of "not over 6 cents per foot," which is to cover the investment in wires and poles for the average residential customer on the grounds that smaller size wires would be used for an average residential consumer using 550 kw.-hr. per year. The size of wires of the distribution system is determined not only by the load carried but also by mechanical strength requirements. The cost of the poles does

‡*Tables referred to as the source of data will be found in the article entitled "Distribution Costs Subjected to New Analysis," published in the* ELECTRICAL WORLD *of March 18, 1933, and appendices referred to will be found in Mr. Pike's paper published in the second annual report of the Power Authority of the State of New York covering the year ended December 31, 1932.*

not decrease with a reduction in the average kilowatt-hours for all customers to the assumed figure of 550 kw.-hr. for the average residential customer. Since the 6-cent per foot used is supposed to cover the cost of poles and wires, of which the poles account for 5.69 cents per foot, the cost of wires would then be only 0.31 cent per conductor-foot. This is entirely insufficient to cover the bare purchase price thereof even under the present depressed prices of copper, not to mention such other costs as the storing, transportation and installation that must be considered. Reducing the unit price of wire for an average residence customer sounds plausible only because the size used for an average residence customer of 550 kw.-hr. consumption is assumed to be reduced. This does not justify the reduction of the weighted average price shown in Table III, which was reached after giving due consideration to the large number of small consumption customers. This average price must approach very closely the cost per foot for an average residence customer.

(c) *Inconsistency in Unit Cost Figures Used in Article*—It is further stated that the average residential customer's "service of at least 100 ft. of wire will cost close to $4," thus giving a unit cost per foot of wire of 4 cents (Appendix XV, original paper). It is difficult to understand why one kind of wire, which is called "service," costs 4 cents per foot and another wire (which is usually equal to or larger in size than the service wire), which is called "distribution line wire," should cost less than one-half cent per foot.

Investment in poles and wires for an average residence customer, as developed in the article, is therefore inadequate to cover the cost of this part of the distribution investment.

(d) *Corrected Costs.*—Taking into consideration these corrections, and the figures presented in Table III, unit cost of 10.6 cents per foot for wires and poles approximates more closely the actual average conditions for an average residential customer. This figure may be rounded out to 10 cents per conductor-foot.

The investment in poles and wires for an average residential customer may, therefore, be taken as 550 ft. $\times$ 10 cents = $55 plus the necessary overheads which are not included in this calculation and which it is believed should not be less than 12 per cent of the bare physical construction cost. This allowance is necessary to cover the cost of engineering, drafting, supervision, office costs, taxes, insurance and interest during construction. This percentage will be added to the bare physical construction costs to cover the item of construction overheads in all subsequent investment figures developed in this paper.

Taking all these factors into consideration, the corrected investment in poles and wires for an average residential customer becomes $55 $\times$ 1.12 = $61.60, as compared with the figure of $30 given in the article.

2. *Line Transformers*—Table I of the article presents data on the investment in line transformers per customer. The calculated average of these figures for fifteen New York companies is $17.61. The approach to the evaluation of $6.50 for investment in line transformers for an average residential customer (Appendix XIV) appears sound except that apparently no consideration was given to the fact that, from a practical operating standpoint, it is impossible and inadvisable to provide merely sufficient transformer capacity to meet the actual load requirements of the customers. The necessity for capacity in excess of actual demand is due to several reasons, the major ones being the requirements for reliability of service supply, future load, and to control voltage drop. Experience of distribution engineers indicates that a ratio of 85 per cent between the actual maximum load on transformers and their capacity is required by sound and conservative operating practices. In the derivation of investment in transformers applicable to an average residence customer the figure of 450 watts was used in Appendix XIV for the diversified maximum load on distribution transformers for an average residential customer with an annual energy consumption of 550 kw.-hr. This figure may be high.¶

However, the figures used in Appendix XIV for the investment in transformers are low, as they apparently do not include the cost of fuse boxes, lightning arresters, grounds, etc. The inclusion of costs for these items will increase materially the transformer costs as shown in Appendix XIV. The higher maximum load and the lower transformer costs used tend to cancel their effect upon the final result.

Taking, then, the required capacity into consideration and adding the cost of construction overheads, the corrected investment in line transformers for an average residential customer becomes $6.50 $\times$ 1.12 $\times$ 100/85 = $8.56, as compared with the figure of $6.50 presented in the article.

3. *Meters and Services*—The article presents, in Table I, information on the investment per customer in meters and services. The calculated average of the figures presented for fifteen New York companies results in $13.24 per customer for meters and $8.86 per customer for services, a total of $22.10 for these two items.

In Appendix XV a figure is arrived at of $15 for the investment in meters and services for an average residential customer. The reasoning in its derivation again fails to take into consideration the fact that the investment shown in Table I has been reduced to nearly that amount which is required by a residential customer because of the preponderance of this latter class of customer to the total number of customers. Although it is true that certain large consumers, usually of a wholesale nature, require special and more expensive metering facilities, the number of such consumers is so small as compared to the total number of consumers that they affect only slightly the difference between the weighted average figure and that applicable to an average residential customer.

Taking the foregoing into consideration, together with the figures presented in Table I, and adding the cost of construction overheads, the corrected investment in meters and services for an average residential customer becomes ($13.24 + $8.86) $\times$ 1.12 = $24.75, as compared with the figure of $15 shown in the article.

4. *Utilization and General*—Appendix X of the original paper develops the general investment chargeable to the distribution system as being 6.82 per cent of the investment in distribution facilities. The derivation of this percentage is not altogether comprehensive, because several of the items included therein are directly chargeable to the so-called distribution activities. These items, when charged directly to the distribution system, tend to raise the percentage as applied to distribution. For lack of any more detailed information, this figure will be used in this discussion except for the correction for construction overheads. The corrected percentage applicable to distribution will, therefore, be determined by the following equation:

$$P = \frac{G \times 1.12}{I \times 1.12} \times 100 = \frac{G}{I} \times 100 = g$$

where:

I = the total distribution investment, excluding construction overheads

G = the investment in general (excluding construction overheads) chargeable to distribution investment

P = general investment (including construction overheads) chargeable to distribution investment in per cent of distribution investment, including construction overheads

g = 6.82 per cent

From the above equation, 6.82 per cent will be applied to the investment in distribution, including construction overheads, to account for the investment in general chargeable to the distribution activities of an average residential customer, giving as the amount of general investment 0.0682 $\times$ ($61.60 + $8.56 + $24.75) = 0.0682 $\times$ $94.91 = $6.47, as compared with the figure of $3.50 shown in the article.

II. Operating Expenses

1. *Distribution Expense*—In Appendix XIX the average per cent of distribution expense, as related to investment in distribution facilities, is derived as 2.97 per cent. In the article, however, 3.5 per cent is used as the percentage applicable to the average residential customer. Since this percentage is apparently developed on

¶*See* ELECTRICAL WORLD, *November 19, 1932, pages 684-688.*

the basis of distribution investment less construction overheads, and since the corrected distribution investment includes the construction overheads, the percentage of distribution expense in terms of distribution investment, including construction overheads, will be reduced to $\frac{3.5}{1.12} = 3.12$ per cent.

The corrected distribution expense for an average residential customer will be ($61.60 + $8.56 + $24.75) × 0.0312 = $94.91 × 0.0312 = $2.96, as compared with the figure of $2 presented in the article.

It is interesting to point out that the corrected figure approaches very closely the average figure of distribution expense per customer as shown in Appendix XIX. This is to be expected because of the important influence the weight of the large number of residential customers exercise upon the weighted average expense per customer.

2. *Utilization Expense*—Nothwithstanding the fact that the average in Table IV is $0.703 per customer, it is assumed in the article that $0.50 is sufficient for an average domestic customer. Here again, as in the case of distribution expenses, the weighted average figure of $0.703 closely approximates the actual cost of an average residential customer due to the multitude of small customers who exert a dominant effect upon the weighted average figure. The cost of $0.703, as developed in Table IV, rounded off to $0.70, is fairly representative of the average cost incurred by residential customers where free lamp renewal privileges are not available.

3. *Commercial Expense and New Business Expense*—For reasons similar to those advanced for the distribution and utilization expenses, the average cost figures of $3.22 and $1.81, as developed in Tables V and VI, will be rounded off to $3 and $1.80 and used for commercial and new business operating expenses as compared with the figures of $1.80 and $1.25, respectively, presented in the article.

4. *General Expense, Excluding Taxes and Renewals and Replacement Appropriations*—Appendix XXIII derives the general expense applicable to distribution activities as being 1.9 per cent of the investment in distribution facilities. While, as in the case of "general investment," this allocation cannot be considered as entirely comprehensive because some of the items included under the general expense (such as "uncollectible consumers' accounts") should be directly charged to distribution activities, the figure of 1.9 per cent will be used—corrected, however, for the construction overheads included under the distribution investment.

The corrected figure will, therefore, be $\frac{1.9}{1.12} = 1.7$ per cent of the investment in distribution, including construction overheads, and the corrected amount of general expense chargeable to distribution for an average residential customer will be $94.91 × 0.017 = $1.61, as compared with the figure of $1.05 shown in the article.

III. Working Capital

As pointed out in the previous discussion, the operation and maintenance of the distribution system, the expenses of the commercial and new-business departments, the emergency arising in restoring service, the delay occasioned by the collection of the revenue from customer, etc., require the utility rendering the service to keep on hand a constant supply of ready cash and supplies and materials in storerooms, which, for all practical purposes, may be considered as frozen and thus constituting an additional tangible cost item of distribution which must be included under any equitable cost of service study.

Opinions vary as to the necessary magnitude of this item. Each individual case must be given special consideration. In order to include a fair allowance for this item of cost in this study as chargeable to the distribution activities, 25 per cent of the operating expense which comes under the heading of distribution will be used to cover the necessary cash and material and supplies in stock.

On the foregoing basis, the working capital apportioned to the distribution activities for an average residential customer will be ($2.96 + $0.70 + $3.00 + $1.80 + $1.61) × 0.25 = $10.07 × 0.25 = $2.52.

IV. Fixed Charges

On pages six and seven of the paper as published by the Power Authority of the State of New York are derived and fixed charges applicable to investment as follows:

	Per Cent
Return on investment	7
Renewals and replacements	3
Taxes (excluding federal income tax)	1.4
Insurance and rounding off	0.1
Total	11.5

The item of "renewals and replacements" was raised from 2.38 per cent (the average for 17 New York companies). This is proper since it is applied to the investment in an aerial system whose life expectancy is, of course, considerably less than that of an underground system or a mixed aerial and underground system.

The allowance for taxes is low and does not take into consideration federal income taxes, which, in accordance with the decision of the United States Supreme Court,‖ should be considered as part of the cost of rendering service when determining the fair rate of return.

Since the fair rate of return in this article is assumed to be 7 per cent, this tax in per cent of the total investment in capital may be approximately calculated as follows:

$$\frac{1}{C}\left(\frac{7}{100} \times C - \frac{5}{100} \times \frac{50}{100} C\right) \times \frac{13.75}{100} = \frac{T}{100}$$

where:

- 7 = the assumed fair rate of return on investment in per cent
- C = the investment in fixed capital and working capital
- 5 = the assumed average interest rate on bonds in per cent. This interest is deductible from income determination for taxation purposes
- 50 = the assumed percentage of bonds to the investment in fixed and working capital
- 13.75 = the income tax rate in per cent
- T = the income tax in per cent of investment in fixed and working capital

It is to be noted that the assumed values in the above equation are considered as approximating only, to a fair degree, the average conditions. Solving this equation, T becomes equal to 0.62 per cent, which when added to the figure of 1.4 per cent developed in the article increases the total tax percentage to 2.02. It should be noted here that this percentage, in so far as the aerial distribution system is concerned, is probably low, since many towns, cities and municipalities levy taxes on poles and overhead wires which are directly chargeable to the distribution system. The figure presented in the article, however, will be used, corrected for the inclusion of construction overheads and the addition of the income tax percentages. Thus the tax percentage becomes $\frac{1.4}{1.12} + 0.62 = 1.25 + 0.62 = 1.87$ per cent.

‖*Galveston Electric Company vs. Galveston, 258 U. S., 388.*

The corrected fixed charges will be:

Applicable to Fixed and Working Capital	
Return on investment, per cent	7.00
Federal income tax, per cent	0.62
Total, per cent	7.62
Applicable to Fixed Capital Only	
Renewals and replacements, per cent	3.00
Taxes excluding federal income tax, per cent	1.25
Insurance	Included under General Expense
Total, per cent	4.25

Major principles in the cost of distribution

The article in ELECTRICAL WORLD brings out two vital and well-known principles affecting the unit cost of distribution per kilowatt-hour of rendering electric service:

1. For a given customer density and with all other things equal, the total cost of distributing energy to retail consumers, within reasonable limits of energy consumption, is affected to only a very slight degree by the quantity of energy consumed.
2. For a given type of construction and within reasonable limits of energy consumption, the cost per customer of the distribution system varies inversely with the variation in customer density.

Costs per kilowatt-hour are thus meaningless and misleading when discussing the problem of the cost of distributing electricity. Should the consumption of an average customer be doubled, the cost per kilowatt-hour will be almost halved, and, conversely, should the consumption for an average customer be halved, the cost per kilowatt-hour will be practically doubled, but the total cost per customer is not affected to the same degree. When the kilowatt-hour unit of measurement is used for comparing distributing costs between territories or groups of customers within a given territory, consumption per customer may easily account for the apparent wide differences in the cost per kilowatt-hour.

From the second principle, it becomes evident why cost of distribution facilities per customer will vary. No intelligent comparison can be made between the cost of distribution facilities between territories or groups of customers within each territory unless the customer density is known, even though all other conditions may be identical. From the corrected figures presented in this paper, the investment in distribution facilities (poles and wires only) for a customer density of 550 conductor-feet per customer, equivalent to approximately less than ten customers per conductor-mile, is $61.60 per customer. Should the customer density figure be doubled, the investment in poles and distribution wires per customer will be practically halved, and, conversely, should the customer density be halved, the investment per customer will be almost doubled.

This variation is an important factor that must be considered when discussing costs of distribution facilities.

Pike's paper a good beginning

Mr. Pike is to be commended for his earnest endeavor to obtain a solution of the much-discussed problem on the cost of distribution. He has apparently erred in some of his conclusions, but this fact does not diminish the value of his contribution to the art of scientific cost-finding procedure. It is hoped that he will revise his conclusions in the light of the additional thoughts so as to make his study of even greater value.

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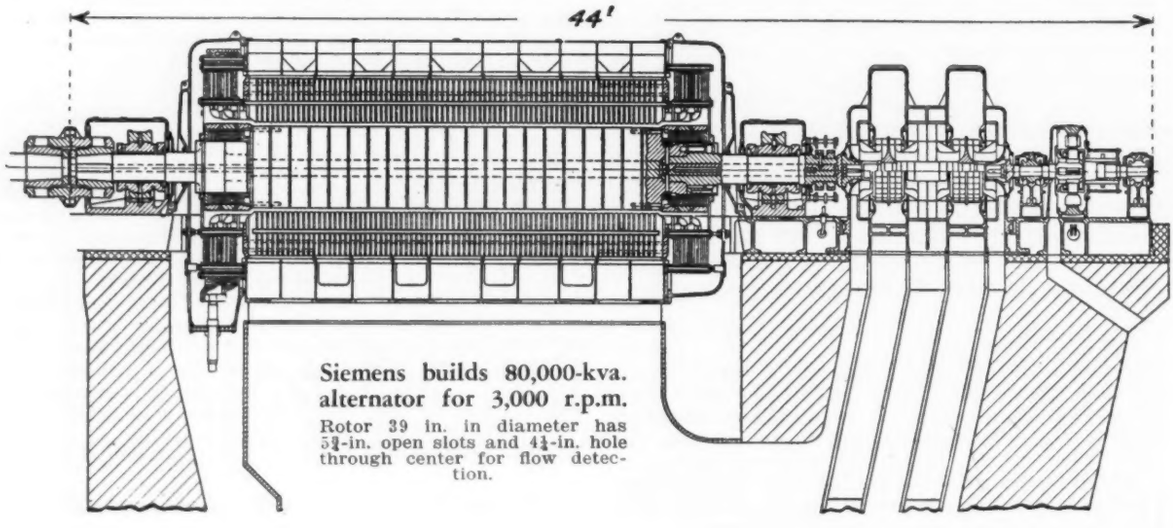
Peripheral Turbine Speed 346 Miles per Hour

Only a few years ago a capacity of 20,000 kva. was considered the ultimate limit for 3,000-r.p.m. turbo-generators. But the highest degree of engineering skill and the very latest accomplishments of metallurgists in alloying quality steel were combined a few months ago to design and build by far the largest single-rotor generator for 3,000 r.p.m., with an output of 80,000 kva. at 0.75 power factor under a pressure of 10,500 volt (50 cycles). A recent (May-June) issue of *Siemens Zeitschrift* describes this machine as supplied to Interescant in Belgium.

The rotor of this machine consists of only three parts: A forged cylindrical part, made of chrome-nickel steel, 39 in. diameter and 200 in. long, with a forged and machined hole of 4¼ in. throughout its entire length, permitting very easy inspection for internal flaws. Into its two end flanges two short stub shafts, 28 in. diameter, were heat shrunk and bolted. The rotor winding, made of copper bars insulated with mica, is lodged in 36 open



Siemens builds 80,000-kva. alternator for 3,000 r.p.m.

Rotor 39 in. in diameter has 5⅜-in. open slots and 4¼-in. hole through center for flow detection.

slots, each 5¾ in. deep. The extending ends of the rotor winding are covered with caps, forged from highest grade non-magnetic steel with a flow limit of 30 per cent. Since the rotor steel has a flow limit of 18 per cent, the caps, representing usually the critical part of a high-speed rotor, are therefore by far stronger than the main body.

No attempt was made to bandage and fix the ends of the rotor winding. They are free to expand within the caps due to heating and centrifugal force. The rotor design offers a 2.6 safety at rated speed and 1.7 at the prescribed 25 per cent overspeed. Completely finished, the rotor weighs 42 tons.

The stator is built up from low loss laminations (0.84 watt per pound), held in a fabricated housing, closed at both ends with castiron end shields. The three-phase copper winding consists of transposed bars, arranged in double parallel Y. The complete stator weighs 114 tons.

A satisfactory cooling of this large generator has been obtained by two external blowers, mounted on an extension of the main shaft beyond the outside bearing. These two blowers can furnish up to 21,600 cu.m. of air per hour. The path of the air blast is directed partly along the air gap and partly through numerous length and cross canals of the stator. Under full load the air leaves the machine with a temperature rise of 26 deg. C., of which a rise of 7 deg. is due to the blowers. This arrangement keeps the copper rise in the rotor to 85 deg. at rated load and 0.75 power factor.

The losses of the generator are as follows:

	Kw.
Friction of generator and blowers	820
Iron losses at 10,500 volt	295
Copper losses	480
Excitation	121

From this can be computed an efficiency at full load and 0.75 power factor of 97.2 per cent. Under short circuit and full excitation the first half cycle will reach fifteen times normal current (15 × 4,400 amp.).

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Two-Speed Spinning Frame Drive Increases Output

Automatic control of spinning frame speeds through the use of wound-rotor induction motors has lately attained considerable momentum in this country as a means of increasing production without breakage of yarn through excessive tension. In ordinary practice where the spinning frame operates at constant speed from the beginning to the end of the doff the tension is maximum at the start and is considerably reduced after a certain amount of yarn has been built on the bobbin. This necessitates cutting down the speed at the beginning to avoid excessive end breakage. Later in the doff a higher speed could be run, but in the past there has been no means of securing this.

A two-speed drive has been developed to furnish a means of operating at slow speed for any desired period at the start of the doff, later shifting automatically to the desired higher speed by the use of suitable mechanical attachments and contactor controls for inserting resistance in the wound-rotor circuit. According to the Whitin Machine Works, which has carried on research and development in this field in conjunction with the Westinghouse company, it is necessary to spin only about 20 per cent of the yarn at lower speed, while the speed during the spinning of the remaining 80 per cent of the yarn may be 10 to 15 per cent above the ordinary constant speed obtained with non-variable speed motor drives. In practice when using two-speed motor drives the motor may be stopped and started at any point within the doff without end breakage or strain on parts of the frame, since it is always started at reduced torque through the magnetic control. In case the motor is started during the high-speed portion of the doff the transition from low to high speed is cared for by a suitably timed relay. In the latest equipment the pre-set slow speed may be easily adjusted to any value down to 30 per cent under the high speed by adjusting resistor taps in the control cabinet. Winding back the builder insures that the next doff will start at slow speed after bobbin filling, and the operator of the spinning frame is not required to effect any speed transitions in repeating the cycle.

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READERS' FORUM

Compensating Meter Fully Practicable

To the Editor of the ELECTRICAL WORLD:

On page 46 of the July 8 issue under the heading "Compensating Meter Limited in Applicability" is included a report of the discussion of my paper, "Compensating Metering in Theory and Practice," as presented at the summer convention of the A.I.E.E. in Chicago on June 27.

There are several differences between my recollections of this discussion and the reports as printed. Perhaps the most important feature refers to Stanley Green's discussion, who, according to the ELECTRICAL WORLD, would *restrict* the compensating meter to statistical purposes. Mr. Green's discussion actually was to the effect that the paper discussed mainly billing metering and he would *extend* the use of the meter to include also statistical installations.

In answer to the various adverse comments, as indicated in the July 8 issue, I indicated that for routine installations, practically all of the required engineering had been done in the paper; that transformer loss data is obtainable from the manufacturers of the transformers; that the determination of setting points for the meter does not require an engineer, but can be done by metermen; and that the compensating meter itself is interchangeable between installations.

With any new development, adverse criticism is frequently the result of experience with other methods of obtaining the desired results, and while I agree that the use of the compensating meter may not be economical or practical, in *all* cases where primary metering is now installed, and that its use for three-winding and tap-changing transformers does not require special engineering, it is also true that in many cases of high-tension metering the compensating meter offers a practical and more economical solution than present practice.

Meter Division
Philadelphia Electric Company. G. B. SCHLEICHER.

BOOK REVIEWS

Vector Analysis

By H. B. Phillips, Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York. 236 pages illustrated. Price, $2.50.

Vector analysis is presented in a form to be useful for work in theoretical electricity and hydrodynamics. A study is made of vector fields and the quantities required to analyze these fields. Fundamentals of vector operations and the general properties of scalar and vector fields are followed by details of field analysis, the property of potentials and linear vector functions. While developed by a mathematician and highly technical in some aspects this book should enable the advanced student to use the convenient vector tools for solving many engineering problems.

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Braunsche Kathodenstrahlröhren

(Braun Cathode-Ray Tubes)

By E. Alberti. Julius Springer, Berlin. 214 pages, 154 illustrations. Price, paper 21 reichsmarks; bound 22.20 reichsmarks.

Cathode-ray oscillographs have proved to be so useful in electrical technology, especially in the investigation of high-frequency phenomena, that a book on their mode of operation and their application to a wide variety of problems is timely. The author has, in addition, reviewed questions of priority by a critical search of patent literature, according to the preface. Annotations are given to 290 references in periodical literature. There is an index of authors and one of topics. The book should be of particular value to transmission and research engineers.

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Sparks From the Electrode

By C. L. Mantell. Published by the Williams & Wilkins Company, Baltimore, Md. 127 pages, illustrated. Price, $1.

"Arcs at the electrode" would better have described this romantic tale of a century of progress in electrochemistry. In lay language and in humanized chronology it tells of the origin of the aluminum, carborundum, carbide, cyanimide and dozens of other industries built on electrolysis, electrowinning and electrodeposition. As in his Electrochemical Society paper (ELECTRICAL WORLD, October 8, 1932), the author paints a grand future for the union of energetic electrochemistry and cheap electrical energy. Commercial power sales staffs will get a new inspiration from reading this little book.

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Year Book, American Bureau of Metal Statistics

Published by the bureau, 33 Rector Street, New York City. 112 pages. Price, $2.

Like its predecessors, this thirteenth annual issue is packed with a diversity of data on the production and consumption of copper, lead, zinc, gold, silver and other non-ferrous metals for various countries throughout the world. The numerous statistical series cover various terms of years, carried through 1932. Among the non-statistical items of information are the names of principal producers, smelters, refineries of the several metals under consideration. The volume should be of outstanding usefulness to persons concerned with the metal industries.

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Geschichtliche Einzeldarstellungen aus der Elektrotechnik, Band III

(Historical Monographs in the Field of Electrical Engineering)

By W. Weicker, E. G. Fischinger, P. Poschenrieder. Elektrotechnische Verein in Berlin, Berlin-Charlottenburg 4, Bismarckstrasse 33. 125 pages, 153 illustrations. Price, paper, 5.00 reichsmarks; bound, 5.50 reichsmarks.

For some years the Society of Electrical Engineers in Berlin has been sponsoring the publication of historical studies in electrical technology. The present volume is the third of a series, and follows one published in 1929 on the development of high-tension switching. It consists of three monographs. The first and longest deals with the development of line insulators, including American practice; the second tells the story of the first 100-kv. line in Europe; the third is a tale of personal recollections beginning with 1880.

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Traveling Waves on Transmission Systems

By L. V. Bewley. Published by John Wiley & Sons, Inc., 60 Broadway, Brooklyn, N. Y. 334 pages, illustrated. Price, $4.50.

A fundamental and generalized mathematical analysis of traveling waves on transmission lines and in transformer windings. Operational calculus is used to evaluate the effects of any arbitrary impulse voltage. The general origin, characteristics and behavior of traveling waves, whether from lightning or high frequency oscillations or terminal transients, are discussed. Reflections, attenuations and distortions, transition points and actions on single and multiple conductor circuits are treated thoroughly. This is an advanced text on a very important subject and is used in the advanced engineering course of the General Electric Company.

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Starkstrommesstechnik

(Measurements in Electric Power Engineering)

By G. Brion and V. Vieweg. 458 pages, 530 illustrations. Published by Julius Springer, Berlin. Price, 37.50 reichsmarks.

Recent developments in the art of measuring electrical quantities and properties warrant the publication of a modern book in this realm. The present volume, produced by the collaboration of a number of specialists and bearing the subtitle "A Manual for Laboratory and Practice" is designed primarily for engineers and technical physicists. The style is descriptive, critical discussions and theory being made available to the reader by copious references to original sources. Methods are considered that have but lately emerged from their former restricted use in special investigation. Typography and cuts are commendable.

Men of the Industry

JOEL D. JUSTIN, formerly hydro-electric engineer of the United Gas Improvement Company, has established a consulting engineering practice with headquarters in Philadelphia.

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JAMES E. AVERETT, assistant sales manager of the Savannah (Ga.) Electric & Power Company, has been appointed sales manager of the company, succeeding James B. Hodge, who has been transferred to Baton Rouge, La. Both these properties are constituents of the Engineers Public Service Company.

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FREDERICK L. SCHLEMMER, of Charlottesville, Va., has been appointed superintendent of the government power plants at Muscle Shoals. A hydro-electric engineer, Mr. Schlemmer has been engaged during the past two years in building a steam plant at Bremo Bluff for the Virginia Public Service Corporation.

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HENRY H. GEARY, pioneer in the development of incandescent lamps, and formerly sales executive of the lamp division of the General Electric Company, has become a member of the board of directors of Air Conditioning Industries, Inc. Many years ago Mr. Geary was associated with one of the independent lamp companies acquired by General Electric. He retired from business four years ago.

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LOUIS H. HAIGHT has been elected secretary and treasurer of the Ward Leonard Electric Company, Mount Vernon, N. Y., to succeed Walter H. Mott, resigned. Mr. Mott is retaining his position on the board of directors.

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DR. WALTER N. POLAKOV of New York, industrial and management engineer, has been appointed to the engineering staff of the Tennessee Valley Authority. Born at St. Petersburg, Russia, he received his M.E. degree at the Royal Institute of Technology at Dresden. He became a naturalized citizen soon after coming to the United States in 1906. Since 1919 he has been president of the firm which bears his name. As power expert with the Shipping Board Emergency Fleet Corporation during the war he handled the problem of power supply for the eastern coast, was in charge of graph control of export and import and, incidentally, was consultant to the Department of Labor. Prior to the war Dr. Polakov was superintendent of motive power for the New York, New Haven & Hartford Railroad Company and consulting engineer for the Board of Estimate and Apportionment of the city of New York. He is a member of the American Society of Mechanical Engineers, Society of Industrial Engineers, the Illuminating Engineering Society and of other technical associations.

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HARRY W. BARNARD and HERBERT T. DYETT, who recently resigned from executive positions with the General Cable Corporation, have been elected president and chairman of the executive committee, respectively, of Rome Company, Inc.

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DWIGHT R. G. PALMER, who was recently elected president of the General Cable Corporation, will retain charge of sales together with his new duties as president. Contrary to the statement in ELECTRICAL WORLD, August 12, page 223, Dr. Frank M. Potter, new vice-president, is not directing sales.

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WILLIAM STOECKER, head of the William Stoecker Engineering Company, Webster Groves, Mo., has been appointed by Governor Park to succeed Milton R. Stahl of St. Louis as a member of the Missouri Public Service Commission. As a consulting engineer, Mr. Stoecker has served a number of municipalities throughout the country in the designing of various public improvements.

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WILLIS A. NAUDAIN, formerly meter department supervisor of the Montreal Engineering Company, Ltd., for companies controlled by the International Power Company, Ltd., has recently organized the firm of Naudain & Company with headquarters in New York. The new company will act as manufacturers' export agent for a number of American manufacturers of electrical instruments and other engineering equipment.

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WARREN A. EDSON has been reappointed chief of the smoke inspection division of the Massachusetts Department of Public Utilities, succeeding David A. Chapman, who retired as a result of recent legislation curtailing the scope of and appropriations for this work. Mr. Edson has been employed by the division for the past 22 years, having joined its staff a few months after its organization under the former Gas and Electric Light Commission of Massachusetts. He was chief inspector from 1915 to 1930, at which time the duties of the division were expanded to cover boiler plant design scrutiny from the smokeless combustion viewpoint, under Mr. Chapman as chief.

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HARRY L. THOMSON, for some years superintendent of the lighting department of the Hartford Electric Light Company, has been appointed meter and appliance engineer. EDWARD Y. RICE, assistant superintendent, has been appointed head of the department. Mr. Thomson has long been active in utility affairs and of late has conducted researches for the Hartford company in connection with the development of electric water heating equipment and rental type electric ranges.

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OBITUARY

WYLLYS E. DOWD, JR., engineer and vice-president of the Foster-Wheeler Corporation, New York, died, of pneumonia, at Greenwich, Conn., August 14, in his fifty-seventh year. Mr. Dowd was graduated from Sheffield Scientific School, Yale, in 1900, and had been connected with the Foster-Wheeler Corporation for the past 27 years.

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WALTER B. BROCKWAY, some few years ago connected in executive capacities with various Ford, Bacon & Davis properties, died August 11 in Portland, Me., where he had resided since 1914, when he withdrew from the public utility industry to become comptroller of the Berlin Mills Company, now the Brown Company. Mr. Brockway's forte was accounting, and aside from the work that he did in helping to standardize utility accounting, he wrote frequently on this subject for the technical press. He was active in the affairs of the American Electric Railway Accountants' Association, serving as its president in 1906-07. At that time, having a national reputation in the accounting field, Mr. Brockway was chosen to represent the receivers of the Knickerbocker Trust Company, New York, when that institution failed during the panic of 1907. Among the utility positions held by Mr. Brockway were as secretary and treasurer of the Toledo, Bowling Green & Fremont Railway, secretary-auditor of the New Orleans & Carrollton Railroad, Light & Power Company, secretary and treasurer of the Sierra & San Francisco Power Company and as general auditor of the various Ford, Bacon & Davis and Newman properties in the South and West.

New Equipment Available

Totally Inclosed Fan-Cooled Motor

A totally inclosed, fan-cooled motor which is fully protected with all the advantages of dust-tight construction and is the same size as the ordinary open type motor of same rating has been announced by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. Full protection is provided against explosive dust, abrasive dust, corrosive gases or fumes, current-carrying dust and steam or moisture. The motors are made in sizes from 1 to 200 hp. as squirrel-cage induction motors to meet all classifications of torque and inrush requirements with one, two, three or four speeds. They are available also as across-the-line-start motors up to 200 hp. and can be supplied for power-factor correction as 100 per cent or 80 per cent leading power-factor induction motors in all sizes.

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COMPLETE LINE OF SPLASH AND DROP-PROOF MOTORS AND CONTROL for every machine requirement has been announced by the Westinghouse Electric & Manufacturing Company. This equipment is especially suited to the requirements of machines where splashing occurs. Splash- and drip-protected, this equipment is ideal for use in dairies, meat-packing plants, canneries, etc., and wherever water should be guarded against for the most dependable and economical operation of electrical equipment.

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FOR MEASURING THE AMPLITUDE of vibration in machinery and power equipment an instrument known as the Starrett "Vibrometer" has been announced by the L. S. Starrett Company, Athol, Mass. It is particularly useful for checking the balance of units revolving at high speeds, such as turbine rotors, by simple comparative readings and is designed for ease and convenience of use.

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A VACUUM-TYPE PHOTOELECTRIC TUBE having a new order of sensitivity has been announced by the General Electric Company. Designated as Type FJ-114, it is made in an automobile headlamp bulb and is fitted with the standard single-contact bayonet-type base, so that it is more easily mounted in crowded locations. The new tube has about the same sensitivity as the usual gas tube and the stability of the usual vacuum phototube. The activation process which produces high sensitivity is also responsible for an unusual increase of the infra-red sensitivity. Its limit extends so low that the tube responds to the heat from a body that is not even glowing in the dark (a wave length beyond 12,000 Angstroms, or a temperature of about 500 deg. C. or 900 deg. F.).

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Low-Voltage Cable Terminals

Standard line of low-voltage, solid-filled cable terminals suitable for use on single-conductor insulated cables rated at 34.5 kv. or less has been announced by the General Electric Company. The terminals are available for use on paper or varnished-cloth insulated, lead-covered power cables of all conductor sizes 2,500,000 circ.mil and smaller. Each unit is guaranteed to withstand, without deterioration of insulation, any voltage withstood by the standard cable for which the terminal is designed.

The terminals are designed for positive exclusion of moisture from the cable end, to insulate the cable end, to withstand both switching surges and lightning disturbances on the exposed line to which the cable terminal is connected and to reinforce the cable end insulation so as to render it electrically stronger than the cable itself.

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Flashovers Indicated by Inductive Device

Induction in an insulated 13-ft. loop when lightning strikes a transmission pole or tower actuates a tube indicator in a new device described in *A.E.G. Progress* (Vol. 1933, No. 2). An insulator flashover will also induce enough voltage in the loop to explode one of the six small tubes and in so doing trip a flag which shows through one of the six windows in the small indicator box. The next tube is automatically thrown into circuit ready to record the next flash. It is suitable for lines above 33,000 volts. The explosive tubes are contained in airtight, weatherproof compartments.

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AN ADVANCED TYPE OF WATER TURBINE-GENERATOR UNIT for standby lighting and small power service for all places where reasonable water pressure is available has been announced by the J. M. Voith Company, Inc., New York. The turbines have vertical shafts—although in many cases horizontal shafts may be supplied—spiral casings, movable gates and high-efficiency runners. The generators are of standard domestic manufacture, 125 or 250 volt, compound wound, and with constant voltage field windings.

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Multi-Polar Rotary Switch

Multi-polar rotary switches for use in any equipment or apparatus requiring one to six poles, either single or double throw, where low capacitance between live parts and ground is essential, have been announced by the H. H. Eby Manufacturing Company, Inc., Philadelphia, and are recommended by the manufacturer for their speedy, positive action and exceptionally long life. They are also dependable and suitable to circuits for precision measurements and permanently low contact resistance, due to a positive wiping contact construction. These switches are adaptable to a variety of systems because of their multi-polar construction and single- or double-throw action and their many outstanding characteristics make them especially adaptable to electronic equipment.

Some of the features of these switches are: All-steel corrosion-proof frame, high-grade spring phosphor bronze, silver-plated, low-contact resistance, and the bush mounting is recommended for one-, two- and three-pole construction, but can be furnished for lug mounting. Lug mounting is recommended for four-, five- and six-pole switches to aid rigidity.

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A METAL-CLAD SWITCH for service up to 15 kv. has been announced by the Delta-Star Electric Company, Chicago, Ill. This switch serves as a safe, convenient and easily installed three-pole group-operated switch for use in industrial plants. The three switch blades carrying fuses are interlocked and simultaneously opened and closed by means of a locking type external handle. A screened opening permits easy inspection of the fuses and sufficient ventilation for the equipment. Above the screened opening is a panel easily removed for replacement of blown fuses.

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WESTINGHOUSE LAMP COMPANY, Bloomfield, N. J., announces an electrode for neon and other gaseous vapor signs, known as the WL-760, which is coated inside with a special material that has a low electrode drop of potential. In life tests a 3-mm. neon tube, equipped with WL-760 electrodes, was operated for 13,000 hours at a current of 30 milliamperes and 10,000 volts without a drop in gas pressure, it is claimed. Easily freed of gases, the electrode requires a seasoning period of only a few minutes.